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THE ELECTRIC VEHICLE AND THE CENTRAL STATION.

Careful estimates place the total number of electric vehicles in service in this country at 37,000; of this number 25,000 are of the passenger type and 12,000 are devoted to business purposes. Considering the innumerable difficulties that had to be overcome this is indeed an admirable record and, yet, it is justly claimed by the manufacturers that this figure would have been greatly exceeded had central stations generally extended their united support.

It is obvious to those who have followed the development of the industry that many electric-service companies have been reluctant to offer their co-operation to vehicle manufacturers in promoting the use of electrics and even today, in spite of the vast amount that has been written on the subject and in spite of the experiences of the more progressive companies which have extended their co-operation, there are companies who fail to comprehend the opportunities offered by the electric vehicle to increase the sale of current.

For the benefit of such companies there are certain pertinent facts that cannot be too strongly emphasized nor too often repeated. A live central station interested in developing its business today spends about 2.5 per cent of its gross revenue in soliciting and advertising, or, for an increase of business of 10 per cent, it is found to be necessary to spend about 25 cents for each $1 of increased annual revenue in getting business and in advertising. On the same basis, considering the annual revenue of a commercial vehicle to be about $175, the central station would be warranted in spending about $45 for such a customer. Considering the revenue from a passenger vehicle, estimated at $80 per year, the permissible expense for advertising and soliciting becomes about $20. It is quite possible that when the desirable nature of this load is fully realized and the advertising incidental to the use of the electric vehicle and the general improvement in commercial and civic conditions is taken into consideration, central-station companies might be warranted in spending as much as $60 for each commercial truck and $25 for each passenger vehicle placed. Yet there are companies who even in their own service use gasoline trucks.

However, the actual amount of money which the electric service company appears to be justified in spending would not be a fair measure of its efforts toward the greater sale of electric vehicles, for such companies have complete working organizations in close touch with

every industry in their respective cities and are already doing business with practically every industry. Central stations have the confidence of their customers, and their representatives are looked upon and referred to as authorities on related commercial and engineering questions. In fact, central-station expansion has been made possible by virtue of public confidence quite as much as by economic law. This confidence, then, which the public already has in the service company can be capitalized in building up demand for the electric vehicle. More, by far, can be accomplished in the advancement of the use of electric vehicles through these representatives than with the same expenditure of energy through any other channel available to the central station. If the central station cannot act as a warm-hearted missionary for the electric, the cost of distribution must invariably restrict production. Furthermore, that distribution will continue to be in the districts of least resistance or selling cost.

While there are limitations to the extent to which the central station can go in pioneering a load-building proposition, and while the development of new business of this character sometimes calls for resources beyond the control of the smaller properties, it is nevertheless true that in many places where adequate resources are available the matter has been disregarded and resources not utilized because there has not been earnest study made of the possibilities of the electric-vehicle load.

It seems that if the merchant is worth cultivating as a market for improved lighting systems, new elevators and industrial motors, he is worth even more as a future off-peak asset, and to remain indifferent to the electric truck, already working successfully in 42 states, is a poor way to capitalize things electrical. As one authority puts it, if the 10,000,000 city horses are looked upon as 10,000,000 small isolated plants, and the horse is pursued with the same devotion to a principle as in the case of the isolated steam plant, the central station and vehicle manufacturer should and will do business on a highly remunerative basis, indefinitely.

HIGH-VOLTAGE SURGES.

In his presidential address, occasioned by his re-election to the presidency of the (British) Institution of Electrical Engineers, Mr. William Duddell has considered the principal causes producing momentary surges of high pressure in electrical circuits. The main portion of this address will be found upon other pages of this issue and will well repay perusal. While the principal facts connected with this class of phenomena are well known to operating electrical engineers and others, it is not often that the subject is so comprehensively and lucidly treated in a conversational style. Moreover, some of the facts brought out by Mr. Duddell may prove new, even to experienced engineers.

In his address, Mr. Duddell included a large number of specific cases of high-voltage surges which had been investigated by means of the oscillograph. While the records of these were both interesting and instructive, it has not been feasible to reproduce them. While the main causes of such rises of pressure were fully discussed, Mr. Duddell did not take up those accidental causes, such as the racing of a generator or crosses between high and low-tension circuits.

Neither has he taken up the means of preventing such pressure rises, nor the precautions to be taken to relieve the insulation from strain when they do occur. Interesting though the discussion of these might be, they could hardly be included in an evening's paper.

While the subject of resonance has been rather thoroughly studied by certain engineers and physicists, the phenomena are somewhat obscure to the average central-station engineer and many of the latter have observed conditions and phenomena which to them have seemed inexplicable. Mr. Duddell has endeavored to make the causes of these occurrences plain and has also thrown light upon the surges due to arcing which may arise from grounds, from opening switches and similar sudden changes in line conditions. Such a collection of information is of value to every engineer.

ELECTRICITY AND THE SAFETY MOVEMENT.

The liberal use of nature's forces has been one of the most potent influences in converting man from a barbarian to a civilized being. In this utilization he has found from experience that each of the natural forces must be used in conformity to nature's laws or disaster results. Thus, fire intelligently utilized is a very docile servant, but when used carelessly or without proper forethought it becomes a most tyrannical master. Electricity likewise can be a very beneficent agent or an extremely destructive power.

In the extraordinary industrial development which has taken place within a hundred years through the increasing use of natural forces and resources, there has been achieved a remarkable decrease in the cost of producing commodities. In the eager desire to obtain results at maximum speed and minimum cost, there has resulted frequently an unintelligent or careless use of otherwise valuable resources and methods, and such use has produced an appalling number of industrial accidents. These in turn have aroused a feeling that our industrial achievements are costing too much in human life and suffering and this has stimulated a strong movement aiming at greater safety, and whose motto is "Safety First." In applying this excellent principle the idea should be, however, not to hamper development, but on the contrary to promote further improvement so as to minimize the effects of ignorance or carelessness that are at the root of all industrial accidents.

Almost every effort to apply electricity to the serv-

ice of man has had to contend with his fear of its danger, an impulse naturally resulting from the manifestation of the terrific power of lightning. This is shown by the opposition formerly encountered in the introduction of overhead trolley wires. The fact is, however, that electricity has fortunately been applied under such safeguarded conditions that it has been no more of a life hazard than purely mechanical apparatus; in fact, it has helped materially in reducing the dangers connected with the latter. For example, the general use of individual motor drive has diminished the use of belting with its constant danger. Variable-speed motors have also reduced the need of gearing. Remote motor control has facilitated the stopping as well as the starting of otherwise dangerous machinery.

The safety movement has been largely anticipated by the manufacturers of electrical machinery and apparatus, who have made consistent efforts to make their products foolproof and safe. A really hazardous piece of machinery cannot nowadays readily be placed in service in an industrial establishment. Insurance inspectors are quick to condemn it if it increases the fire hazard, and factory inspectors are becoming more proficient in insisting upon safeguarding against dangers to life and limb. The care of generators, switchboards and motors is nearly always, and always should be, left to an experienced electrician competent to guard himself and the establishment against electrical dangers.

Despite these conditions, careless installation or negligent supervision of electric circuits and electrically operated machinery sometimes has had unfortunate results. Occasionally also a person unacquainted with things electrical has been left exposed to contact with dangerous electric circuits. While these conditions are clearly due to negligence on the part of those in charge, a more positive means of insuring against such neglect is desirable. The rules covering the installation of electric circuits, machinery and appliances are now excellently embodied in the National Electrical Code to protect against fire hazard, but take altogether insufficient cognizance of the elimination of life hazard. Municipal inspectors frequently are limited in their powers to condemn an installation which, as far as fire hazard is concerned, is strictly in conformity with the Code. Judgment should be sufficient guide for an inspector in such cases, but to smooth his way it is well to have requirements laid down more specifically so that he may have back of him some more generally recognized authority. In connection with intricate circuits of anything over 100 volts and in connection with motor-driven machines it would be well to develop more requirements for minimizing danger. It should be possible to make the slogan "Do It Electrically" synonomous not only with doing a thing conveniently, quickly and cheaply, but also most safely.

FILING TRANSMISSION-LINE DATA.

The design of high-tension transmission lines has become of increasing importance with the growth of modern large power systems, and rule-of-thumb methods formerly considered good enough are rapidly being relegated to the background. While it is true that steel-tower and insulator construction have become pretty well standardized along the line of providing for voltages up to 100,000, the engineering problems associated with the design and installation of large and comprehensive transmissions are by no means simple. In a good many hydroelectric organizations established prior to the last five years one notices a decided absence of complete data bearing upon the line designs and construction in comparison with the scope and thoroughness with which such information is assembled and maintained in some of the latest instances.

In a typical case lately developed for long-distance service an examination of the drafting-room records shows a decided advance in practice along the line of filing calculations, prints and tabular data bearing upon this portion of the work. Upwards of 150 sheets are on file for this line, showing stringing tensions for various temperatures in regions with and without sleet; sag-span curves for conductors and ground wires with and without sleet; stringing data for various spans; erection diagrams for various types of steel towers; clearance plots; stress-deflection curves; tension-sag-temperature curves; tower assembly drawings; details of clamps and anchors; cable-tension and insulator-movement curves; miscellaneous drawings of small parts used in the line construction, and many other data. Doubtless the length of lines involved in the system, and the corresponding cost of their construction, justified a more thorough tabulation of data than would be needed in building a short line through uniform territory, but the very titles of the foregoing outlined data sheets indicate how much the transmission engineer must depend today upon structural mechanics in order to obtain a thoroughly reliable installation.

In other words, extra-high-tension line design is plainly no task for the young engineering graduate alone, but it presents problems whose solution demand a knowledge of stresses and strains, wind pressures, variations of pull and sag with temperature, methods of erection and the like which is not possessed by every man in the electrical field, to put it mildly. The proper filing of such line data is a matter of importance, and even on the small system there should always be on hand prints of the standard towers, elevations and sections of angle towers, extra long spans, especially protected crossings over foreign circuits, and such other information of a complete technical character as will enable spare parts to be quickly ordered, designs checked in dealing with future problems and remedies applied more easily in case trouble develops due to improper design or construction at some local point.

Conference of Electric Sign Manufacturers.

A conference of electric sign and accessory manufacturers was held at the Hotel Sherman, Chicago, December 1, for the purpose of formulating plans for a permanent association. There were present representatives of 14 sign manufacturers, about 5 accessory manufacturers, and others interested in the movement. G. B. Hall, of Jersey City, acted as chairman of the meeting and H. C. Menefee, of Cincinnati, as secretary.

Two sessions were held, one in the morning and one in the afternoon. The former was devoted principally to informal talks on the question of the value of an association to sign manufacturers. Letters were read from numerous companies endorsing the movement for an organization and pledging support to the movement. It was agreed by those present that the industry as a whole would benefit if the manufacturers would organize for mutual protection against some of the evils at present encountered. Standardization of sign construction seems also to be desired.

A committee appointed by the chairman to consider the remarks made and make recommendations as to the desirability of establishing an association, reported at the afternoon meeting. This committee suggested that an association be established, the details to be worked out by an Organization Committee to be elected at the meeting. This committee is to comprise three members and is to draw up a constitution and set of by-laws for a permanent body.

It was further suggested that sign manufacturers comprise the active members and accessory manufacturers, associate members. A requirement for membership as an active member would necessitate the manufacturer using the Underwriters' label service or having his product approved by the Underwriters in the regular manner.

The Organization Committee was elected as follows: G. B. Hall, chairman, National Electric Sign Company, Jersey City, N. J., H. I. Markham, Federal Sign System (Electric) Chicago; and Norman B. Hickox, Greenwood, Advertising Company, Knoxville, Tenn.

It was voted to meet again, in Chicago, within 90 days, to hear the report of this committee, and it was agreed that only those represented, either in person or by proxy, should be entitled to vote on the report.

Progress on the Coosa River.

Officials of the Alabama Traction, Light & Power Company expect to complete all essential work on the dam at Lock 12 on the Coosa River in December. The first unit of the power plant is now being erected and it is hoped to have it ready in February. The Gadsden steam power plant is now supplying 4,000 horsepower.

Wireless Research in England.

One outcome of the recent parliamentary and press discussions on the British Imperial wireless chain has been the appointment of a committee by the British Government with instructions to consider how far and by what methods the state should make provision for research work in the dominion of wireless telegraphy, and whether any organization which may be established should include problems connected with ordinary telegraphy and telephony. Lord Parker of Waddington is chairman, and the committee includes W. Duddell, president of the Institution of Electrical Engineers; R. T. Glazebrook, of the National Physical Laboratory; W. Slingo, engineer-in-chief to the Post Office; Joseph Larmor, secretary of the Royal Society; and Commander Loring, proprietor of wireless telegraphy.

Society for Electrical Development Passes the Thousand Mark.

The steady increase in the membership list of the Society for Electrical Development continues unabated. On November 28 the total number of members reached 1,006, thus fulfilling the prediction of the Society's executives that the thousand mark would be reached before December 1.

During the past week a meeting of sales executives, whose companies are members of the Society, was held at the Society's headquarters in the Engineering Societies Building, New York City. Comprehensive methods looking to the completion at an early date of the Society's prescribed minimum fund of $200,000 were discussed and a plan of campaign was adopted which it is believed will result in placing the Society actively at work by the first of the year.

Safety and Sanitation Conference.

The Safety and Sanitation Conference will be held at Rumford Hall, Chemists Building, 50 East Forty-first Street, New York City, on December 10, 11 and 12, under the auspices of the American Museum of Safety. The conference will be conducted in connection with the International Exposition of Safety and Sanitation. The six sessions, one being held on each morning and afternoon of the three days, will be devoted to papers and reports on every phase of industrial accident prevention and the amelioration and prevention of occupational diseases.

Program of Wisconsin Electrical Association.

Announcement has been made that the next convention of the Wisconsin Electrical Association will be held in Milwaukee, Wis., January 15 and 16, 1914. As in the past, headquarters will be established at the Hotel Pfister.

The entire program has not as yet been completed but several papers of importance have already been decided upon as follows:

"The Cost of Supplying Current to Small Consumers and the General Subject of Rates," by S. E. Doane, Cleveland, Ohio; "Review of New Laws Affecting Public Utilities in Wisconsin," by John B. Sanborn, Madison, Wis.; "The Proper Handling of Depreciation Accounts and Some Phases of Rate Making," by Halford Erickson, of the Wisconsin Railroad Commission; "Electric Railway Traffic Surveys," by R. W. Harris, Madison, Wis.; "A Practical Accounting System for the Small Central Station," by H. G. D. Nutting, Milwaukee, Wis.; "Important Developments in Electricity Meters," by F. A. Vaughn, Milwaukee, Wis.

Several additional subjects of importance to electric railways will be decided upon very shortly. George Allison Stephenson Building, Milwaukee, Wis., is secretary of the Association.

University of Illinois Inspection Trip.

The annual inspection trip of the students in the Electrical Engineering Department of the University of Illinois covered the time from November 23 until Thanksgiving Day. The party left Urbana on November 23 under the direction of Profs. E. B. Paine, Morgan Brooks, E. H. Waldo and J. M Bryant.

One section spent Sunday night at Burlington, Iowa, and Monday was devoted to a visit to the dam and power house of the Mississippi River Power Company at Keokuk. Monday night was spent on the train and Chicago was reached the following morning.

Another section devoted Monday to inspection of the power house of the Sanitary District of Chicago at Lockport and the penitentiary and works of the Illinois Steel Company and American Steel & Wire Company at Joliet.

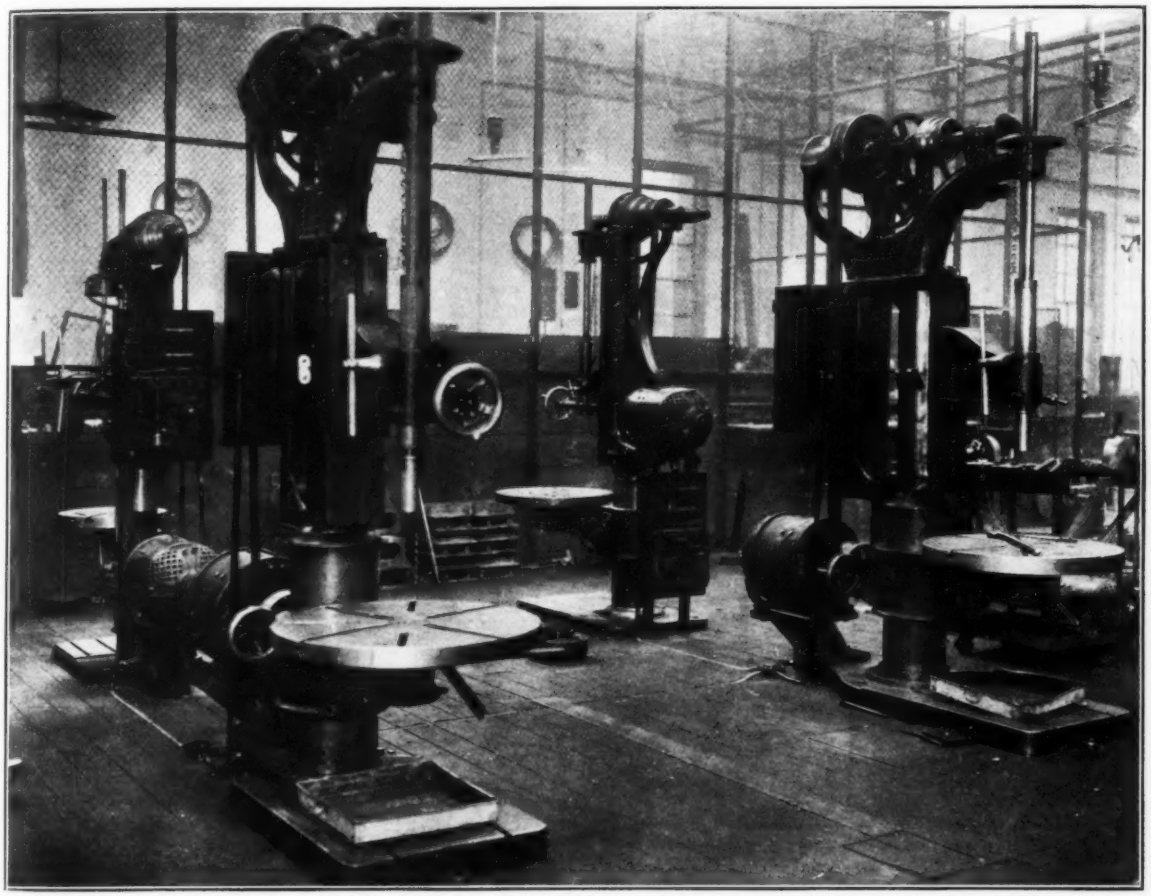
Both sections devoted Tuesday morning to the plant of the Commonwealth Edison Company in Chicago, visiting one of the substations and two of the generating stations. In the afternoon the Hawthorne works of the Western Electric Company were visited.

On Wednesday morning the mills of the Illinois Steel Company at South Chicago were visited and the afternoon was spent in the department store of Marshall Field & Company.

Electricity in Hardware Manufacturing

No line of improvement in hardware manufacturing has contributed more to the securing of low cost of production and high grade of output than the adoption of the electric motor drive. Motor drive for machine tools has come to be recognized as the most efficient, flexible and economical form of power obtainable. Individual motors for the greater proportion of machine tools, and small group drive, have done much to better the general conditions in many factories, increasing the output and at the same time reducing the maintenance cost, eliminating not only the dangers attendant on the many rapidly moving belts and pulleys, but the enormous friction losses in the many bearings and slipping belts.

While, in the aggregate the motor load in machine shops is perhaps greater than in any other one industry, still there is a considerable field yet undeveloped, in so far as central-station power is concerned. This article deals with hardware manufacturing plants, discussing condition, relative to motor drive.



Group of Machines Driven by Individual Motors in Hardware Factory.

While, in the aggregate, the motor load in machine shops is perhaps greater than in any other one industry, still there is a considerable field yet undeveloped, in so far as central-station power is concerned. This applies to the plants devoted to the manufacture of hardware as well as to machine shops in general.

In discussing the application of electric drive to hardware machinery some classification must necessarily be made of the vast number of varied manufacturers in this industry. This article, therefore, will be confined to plants making locks, hinges, bolts, nameplates, etc., other lines being reserved for subsequent articles.

One of the most important phases influencing the successful conduct of any manufacturing establishment is the amount of output obtainable with a given personnel, tool equipment, floor space and working time. Without increasing any of these factors, the substitution of mechanical drive by the installation of electric motors has variously augmented the productive capacity of different shops from 5 to 100 per cent. In other words, a greater amount of work is produced per operative machine per day, due to maintenance of speed under varying conditions of load; the ease by which the maximum cutting speed can be sustained throughout a given operation; the advantage gained by better arrangement of machines in regard to natural or artificial lighting facilities, as well as in the readier access to and sequence of material from the unfinished to the finished state. Finally, because the greater cleanliness, purer air and generally better hygienic surroundings of the motor-driven shop react favorably upon the health, cheerfulness and

activity of the operatives, a feature which influences production.

It is said that the friction losses in ordinary belt-driven shop equipment averages about 75 watts per horsepower for each hanger, and while this may seem to be excessive it is not at all improbable, taking into consideration the fact that hangers must be placed at frequent intervals on a line shaft and in many buildings become much displaced in alinement owing to the settling of floors from varying load strains placed on them and the side strain on the hangers from the countershafts, all of which naturally increase the friction losses.

With belt drive the speed of a machine must necessarily remain practically constant except in the case of lathes or other machines where gearing and cone pulleys are utilized to effect changes, while with motor drive a wide range of speed, suited to varying conditions, is quickly and easily obtained; this feature alone adds to the sum total of the efficiency of the machine and widens its scope of work, saves time in transferring and setting up work, and results in a general saving of time, power and cost.

Speed range in connection with many machine tools is all-important, as the machine is often subjected to rough and ill usage at the hands of the operative, which causes abnormal strains upon the controlling apparatus; this must be so constructed as to be able to withstand the severe conditions which are imposed on it through inexperienced or careless manipulation and yet be reliable of operation, easily accessible and of simple construction.

The necessity of reliable automatic starting and speed-controlling apparatus to meet the requirements of the present-day equipment has brought out some highly efficient types of starting and regulating controllers, automatic and manually operated reversing controllers, float switches, pneumatic-electric and mechanical-electrical devices suited to practically any conditions under which a motor can be used for power, and while the cost of automatic starting apparatus prevents its installation in some cases, usually it will be found that it would have been, in the end, really cheaper and much more satisfactory.

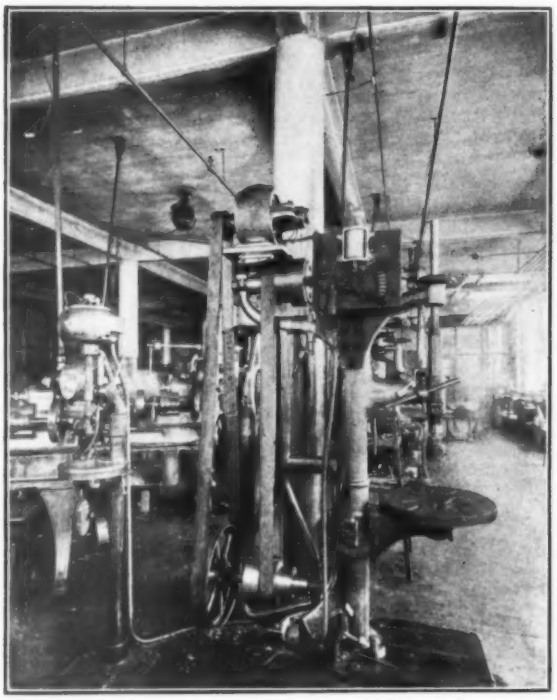
In selecting a motor for driving machine tools it is of great importance that the conditions affecting the machine it will drive are thoroughly understood and allowance must be made for abnormal conditions which may at times be imposed upon it. In the case of a machine which operates at very nearly the same load under all conditions a shunt motor may be used, but if the load varies at different periods, is light at one part of the operation and heavier at others a compound-wound motor is required. Take, for instance, a planer; during the forward motion of the bed of the machine the cut taken by the tool requires a heavy output of power, which suddenly changes to only sufficient to return the bed of the machine to its first position and start it back on another cut.

This means throwing a heavy load on the motor suddenly and also as suddenly releasing it; two moments of rest as the end of the travel is reached, which places the motor under widely varying conditions, all within the space of a few seconds. Unless a motor, under such conditions, is constructed to meet the strains imposed, trouble may be looked for in the way of excessive sparking at the brushes, heating and perhaps a burnout.

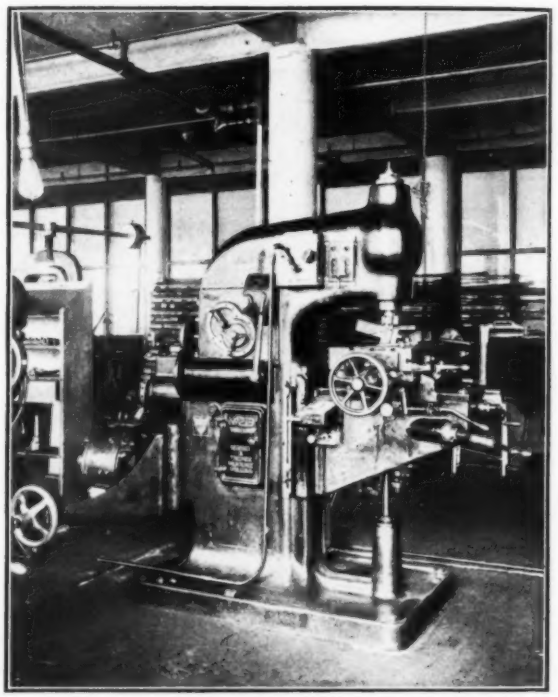
A compound-wound motor, placed on the top of the planer head and belted down to the drive at the sides, gives a very satisfactory result, gearing the motor not being practical owing to the strain at the moments of reversal of the machine bed, while the belt allows a flexibility by way of slip that is impossible with gears, and would put a strain on the motor that woulld soon result disastrously.

Similar conditions, in a measure, are met with in a crank shaper, although the conditions are not as severe as with a planer. By using a motor with a speed range equal to the ratio of the back gear, it is possible to get an unbroken range of from 4.5 to 115.

An emery grinder imposes widely varying demands on the driving motor, considerable power being required to start the wheel from rest and decreasing as the wheel gains momentum and



Group of Individual-Motor-Driven Machines.



Motor-Driven Miller in Hardware Factory.

Hardware Manufacturing Data—Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Hardware plant, located in Western Illinois, manufacturing locks of various sizes and patterns, the material used being brass, steel, cast iron and malleable iron. The average daily output is 5,000 dozen locks. There are 100 men employed, working 10 hours per day. During the winter months a 35-horsepower steam engine is used to drive a large part of the load, but from June 1 to November 1, the entire load is motor driven.

Total connected horsepower, 85. Total number of motors installed, 8. Average kilowatt-hours per month, 3,881.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
January	1,468	May	2,390	September	6,820
February	1,350	June	6,090	October	7,550
March	1,280	July	6,310	November	2,260
April	2,310	August	7,090	December	1,670

Load-factor, 9 per cent; operating-time load-factor, 18 per cent.

The electrical energy consumed per 100 dozen locks manufactured is 5.5 kilowatt-hours.

The following is a list of the motors installed with their respective drives. The supply source is three-phase 60 cycles, 220 volts.

No.	Horse-power	Speed R. P. M.	Application.
1	15	1,120	Belted to an 80-foot shaft, 14 hangers, driving two Ferracute P-1 punch presses, flywheel 26 inches diameter, 130 revolutions per minute; six Ferracute P-2 punch presses, flywheel 30 inches diameter, 110 revolutions per minute; and five Ferracute P-3 punch presses, flywheel 36 inches diameter, 95 revolutions per minute.
1	7.5	1,120	Belted to a 60-foot shaft, eight hangers, and 81 feet of countershafting, 22 hangers, driving one Robertson No. 2 hack saw; one Hamilton 10-inch drill; one Garvin No. 4 plain miller; two Besley No. 10 double-end disk grinders; one 10-inch by 4-inch engine lathe; three Cleveland automatic screw machines; one double emery grinder, wheels 8 inches by 2 inches and 8 inches by 1.5 inches; one Fairbanks 14-inch by 6-foot engine lathe; one Hamilton 14-inch by 6-foot engine lathe; one Garvin single emery grinder, two-inch by 1.5-inch wheel; one Stehman & Swan speed lathe; one 12-inch by 2-inch grindstone; two 15-inch by 30-inch tumbling barrels, 80 revolutions per minute; two 12-inch by 14-inch tumbling barrels; one 30-inch by 42-inch tumbling barrel; and one 12-inch rip saw.
1	10	1,120	Belted to an 80-foot shaft, 15 hangers, and 42 feet of countershafting, 28 hangers, driving one Wilmarth & Morgan style A-25 drill grinder; four Garvin No. 1 hand millers; one Garvin 14-inch hand miller; one Burke No. 1 hand miller; four Barry & Zeiker six-inch drills; three Barry & Zeiker drills; four six-inch drills; one 8-inch by 2-inch double emery polisher; one six-inch by 4-inch double emery polisher; one 14-inch by 1.5-inch double emery polisher; one 6-inch by 2-inch double brush polisher; one 14-inch by 1.5-inch double buffing wheel; one 12-inch by 1.5-inch double brush polisher; two 12-inch by 2-inch double leather-faced buffing wheels; two 14-inch by 2-inch leather-faced buffing wheels; and one 8-inch by 3-inch emery polisher.
1	5	1,120	Belted to a 60-foot shaft, 12 hangers, and 23 feet of countershafting, five hangers, driving one sensitive drill; one six-inch speed lathe; one 1.75-inch metal saw, used to slot key cylinders; two 8-inch by 2-inch double emery polishers; one 12-inch by 2-inch double emery polisher; one 12-inch by 2-inch double buffing wheel; one 12-inch by 2-inch double leather-faced buffing wheel; two 4.5-inch by 24-inch wooden rolls, these rolls run in water and are used to soften leather-faced polishers; and one Champion No. 1 blower, 1,200 revolutions per minute.
1	5	1,700	Belted to a 10-foot shaft, two hangers, and 13 feet of countershafting, four hangers, driving two 24-inch by 30-inch tumbling barrels driven by friction gearing from countershaft; one tumbling barrel driven by chain from countershaft; one American Gas Furnace Company No. 1 pressure blower, 300 revolutions per minute, supplies air at one-pound pressure to a Crawford japan oven.
1	7.5	1,700	Belted to a B. F. Sturtevant blower, 800 revolutions per minute, used for exhausting dust from polishers. During the winter this fan is driven by the steam engine.
1	5	1,700	Belted to a 10-foot shaft, three hangers, and a short two-hanger countershaft driving one Hanson & Van Winkle No. 51 4,000-watt plating generator, running at 1,250 revolutions per minute; one 6-inch by 1.5-inch double polisher; and two 18-inch by 24-inch eight-sided electroplating drums. During winter these machines are driven by steam engine.
1	30	1,120	Direct-connected to a Westinghouse 17-kilowatt, compound-wound, 125-volt, direct-current generator. This plant is used for lighting only and is seldom run.

All motors installed in this plant are of the squirrel-cage induction type.

Hardware Manufacturing Data—Sheet No. 2.

Hardware plant manufacturing various kinds of brass fittings such as brass hinges, locks, etc. Approximately 60,000 pounds of brass are handled per year, which is only 30 per cent of the plant capacity. There are 25 men employed, working 10 hours per day.

Total connected horsepower, 40.5. Total number of motors installed, 7. Average kilowatt-hours per month, 2,232.

Kilowatt-hour consumption for 9 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
February	820	May	990	August	3,520
March	885	June	2,120	September	5,405
April	1,050	July	2,860	October	2,540

Load-factor, 10 per cent; operating-time load-factor, 21.2 per cent.

The electrical energy consumption per 1,000 pounds of brass worked is 289 kilowatt-hours.

Motor Installation.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts. Squirrel-cage motors are used.

No.	Horse-power.	Speed R. P. M.	Application.
1	5	1,120	Belted to a 40-foot shaft and 14 two-hanger countershafts driving one 20-inch by 3-foot engine lathe; one 16-inch by 3-foot lathe; one 24-inch hack saw; one 8-inch drill; two hand millers; one 16-inch shaper; one 12-inch by 3-foot engine lathe; one 30-inch by 3-foot engine lathe; one 22-inch drill; one three-spindle drill; one horizontal drill; and two vertical sensitive drills.
1	5	1,120	Belted to a 20-foot shaft, five hangers and ten two-hanger countershafts driving one seven-eighths inch turret lathe; one Jones & Lamson horizontal drill; one 20-inch miller; one Garvin ferrule slotter; one Warner & Swasey one-inch turret lathe; one 8-inch emery wheel; one special hinge-making machine, four-inch diameter milling tool; one double emery wheel; one punch press; and one plunger pump.
1	7.5	1,120	Belted to a 10-foot shaft, three hangers, and one two-hanger countershaft driving three Ferracute D-2 punch presses; one Gould oil pump; one Rockwell air compressor, 35 pounds.
1	5	1,120	Belted to a 10-foot shaft driving one Ferracute D-2 punch press; and two Ferracute C-1 punch presses.
1	5	1,700	Belted to a 30-foot shaft driving two Bliss No. 202 punch presses; one Niagara No. 101 punch press; one 20-inch by 3-foot speed lathe; and one casting tumbler.
1	3	1,120	Belted to shafting driving one 280-ampere, 3-volt plating generator; one 30-inch band saw; and one engine lathe.
1	10	1,120	Belted to 30-foot shaft driving seven double buffing wheels; and three 15-inch by 2-inch grinders.

Hardware plant manufacturing steel and tin equipment for caskets such as handles, nameplates, etc. The chief operations are plating and the polishing of the metal fixtures. Twenty-five men and girls are employed, working 10 hours per day. The average output is 45,000 pieces per day.

Total connected horsepower, 35. Total number of motors installed, 9. Average kilowatt-hours per month, 3,098.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
October	3,190	February	3,791	June	3,235
November	3,661	March	4,188	July	2,099
December	4,815	April	3,389	August	1,548
January	2,386	May	2,873	September	2,997

Load-factor, 16.2 per cent; operating-time load-factor, 34 per cent.

The electric energy consumed per 1,000 pieces of output is 3.4 kilowatt-hours.

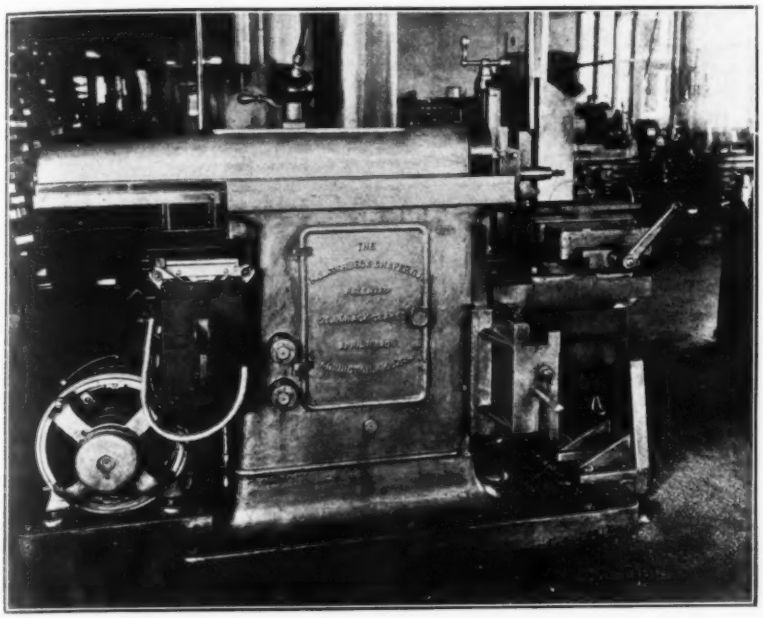
Motor Installation.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts. All motors installed are of the squirrel-cage induction type.

No.	Horse-power.	Application.
1	5	Belted direct to 24-inch Champion exhaust fan.
1	5	Belted to polishing lathe.
1	5	Belted to 20-foot shaft, five hangers, driving two three-wheel polishing lathes; and one two-wheel lathe.
1	0.5	Belted to a Root, size 3½, positive-pressure blower.
1	0.5	Belted direct to scratch brush.
1	10	Belted direct to a 1,500-ampere, 6-volt plating generator, 525 revolutions per minute.
1	3	Belted to a 25-foot shaft, five hangers, driving one doweling machine; one 10-inch rip saw; one air compressor, 40-pounds pressure; one corrugating machine; one slitting shear; and one roping machine.
2	3	Each belted direct to a four-wheel polishing lathe.

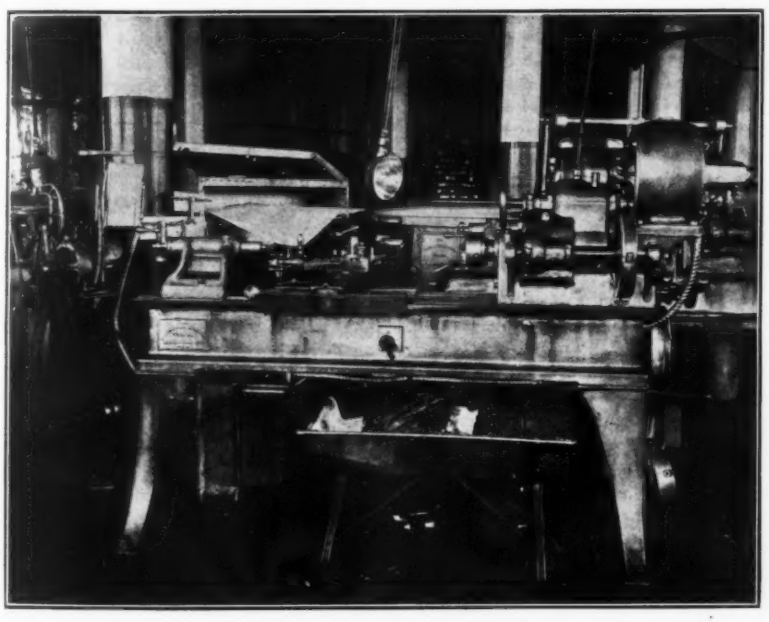
varying as more or less pressure is brought to bear against the face of the wheel in dressing the tool or other work.

Drill presses, boring mills, milling machines, slotters and other machines on which a diversity of work requires different speeds on different metals and classes of work, all require a careful summary of conditions before deciding on the motor to be used to drive them. The majority of woodworking machines require high-speed motors and take less power per machine than in metal-working machinery, but the careful selection of motors is just as essential and the choice should not be made until every point in connection with the demand on the machine has been carefully considered.



Five-Horsepower Motor Driving Shaper.

In the average hardware plant perhaps the engine lathe is most often required to work under varying speeds and conditions up to the limit of its capacity or up to the limit of output definitely fixed by the nature of the material or character of the work to be done. In changing from belt to motor drive the motor is usually mounted on a framing directly over the cone pulleys, milled gear being fitted on the larger cone and engaging either directly with a spur on the motor shaft or with an intermediate gear, if so desired; the starting apparatus, if automatic, may be placed either on the back of the lathe standards or on a nearby post or wall, and thus eliminate all exposed contacts on the lathe itself, only the push-button control, carrying but a fraction of an ampere, being installed on the machine, the conduit being secured to the frame in the least exposed place, and the control button at the most convenient point for the operator.



Motor Geared Direct to Lathe.

Some machine tools are now being built with the motor an integral part of the machine itself or with bosses cast on the frame and planed off ready for drilling for any motor base that the purchaser may wish to install for driving the machine. There is. too. apparently an effort on the part of manufacturers to bring the dimensions of standard sizes of motor frames within a certain limit to better facilitate mounting on machinery, due to the varied demand for different motors for certain machines.

The general advantage of electric motor drive are too well known to need special comment, however, they may be summed up as follows:

(1) Better control and greater range in speed and closer speed regulation. The average increment of speed increases in a belt driven machine tool is almost 50 per cent. In an adjustable-speed motor it is 10 per cent to 20 per cent.

(2) Increased output and decreased cost of production, due in part to increase in amount of power available in motor over that transmitted by belts.

(3) Increased light and cleanliness by elimination of dust and belting.

(4) Greater economy in transmission, especially when tools are running only part of the time, as there is no loss due to driving belts and shafting when tool is idle.

(5) Reduced cost of repair and maintenance, owing to absence of shafts, hangers, pulleys and belts.

(6) Head room for cranes.

(7) More economical disposition of floor area and more convenient location of tools. Machines can be placed to best possible advantage with regard to light and sequence of operation. Additional tools can be readily added to equipment or location changed without any changes which are necessary in shafting when belt-driven tools are used.

(8) Use of portable tools which permits of bringing one or more tools to

the work and thus performing several operations at the same time on a large casting.

(9) Reduced cost of buildings, as absence of shafting simplifies construction.

(10) Reduced cost in installation in many cases, especially for tools in isolated positions where expensive shafting and hangers would exceed the cost of applying individual motors.

(11) Greater reliability and steadiness of power and freedom from stoppage of a number of tools, as in the case of a hot bearing or broken belt.

A large hardware plant in the middle West using motor drive is of especial interest because it may be considered typical of establishments in this field and also because of the arrangement made with the local central station relative to power supply. The plant in question manufactures locks of various sizes and patterns, the material used being brass, steel, cast iron and malleable iron. The average daily output during the entire year is 5,000 dozen locks, 10 hours constituting a day. The electrical energy consumption per 100 dozen locks manufactured is 5.5 kilowatt hours.

An aggregate of 85 horsepower in squirrel-cage induction motors is installed, arranged for small group driving. Owing to the size of the building occupied by this company the question of heating in the winter months seriously interfered with the central-station company's possibilities for securing the business of this firm. After extended investigations, however, it was found that the most economical arrangement, at least for the present, was to purchase power during the summer and operate the existing 35-horsepower steam engine during the heating months. Of course, only a portion of the plant can be driven by this engine and power is purchased the entire year for the additional motors. Eventually the steam engine will be discarded but in the meantime the plant manager has been able to make direct comparisons between steam and electric driving and has become a booster for central-station service.

The kilowatt-hour readings for a period of 12 months indicate the difference in consumption when the engine is used. Starting with April the reading for each month are as follows: 2,310, 2,390, 6,090, 6,310, 7,090, 6,820, 7,550, 2,260, 1,670, 1,468, 1,350, and 1,280.

The motors are divided among the different departments of the plant as follows: Punch shop one 15-horsepower motor driving an 80-foot shaft. Machine shop, one 75-horsepower motor driving a 60-foot shaft, one 10-horsepower motor driving an 80-foot shaft and one 5-horsepower motor driving a 60-foot shaft. This shop is driven by the steam engine in winter. In the Japan room are two motors of 5 and 7.5 horsepower capacities and a 5 and a 30-horsepower motor are installed in the electroplating room. Detailed data on the motor installation of this and other plants are given in the accompanying sheets.

Commercial Practice
Management, Rates, New Business

ELECTRIC COOKING.[1]

By George A. Hughes.

Just 30 years ago, lighting with electricity was exciting great attention, and 20 years ago power applications attracted the attention of the electrical industry. Then the wonderful discovery of the tungsten filament brought attention back to lighting, and today sees the beginning of the serious use of electricity for cooking and heating.

Its use in these directions will do as much to alter the whole life of the people as did the use of electricity for lighting, turning night into day—as the use of electricity as a motive power, cheapening and increasing production, and in its use in railway work, increasing and simplifying travel, have already done.

Many look upon electric cooking as ordinary cooking, with the heat of burning gas or coal replaced by heat from electricity. This is no more correct than it was to look upon electric power as driving by gas or steam power. The substitution of electricity for gas and steam has ceased to be a question of the cost of a horsepower-hour as a prime mover, but a question, as it should be, of annual cost of production of the manufactured article, and quality of the article produced, and it is the same with electric cooking and heating.

Electric cooking and heating can no longer be regarded as a side issue in the central-station field, and in the future must be made the object of serious and persistent attention by every central-station manager who desires to maintain his station among fellow managers.

I am pleased to say that in central-station circles there is a larger and growing preponderance of men who realize the vast commercial possibilities that modern cooking and heating apparatus bring within their reach.

A close parallel exists between electric lighting a few years ago, and electric cooking today. Our competitors laughed at us—said electric current for lighting was several times more expensive than gas and was very unreliable. But with improvements in the lamps, and cheaper current, due to the remarkable fall in the cost of production on account of larger outputs, higher load-factors and more efficient machinery, the conditions have been transformed.

Gas is now the defensive and losing ground more and more rapidly every day.

Many of you will remember, not so many years ago, in the case of the electric motor, how it was claimed that the quoting of special low rates meant disaster to the central station, but somehow the stations that quoted these low rates managed to increase their profits, and the more power business they secured the more prosperous they became.

We are about to see a similar phenomenon in the field of electric cooking, and unless all signs fail the development should be about five times as rapid as that of its predecessors combined.

During the last year there has been made enormous advances in design, reliability and efficiency of cooking apparatus. We can, at the present time offer ranges that can be confidently offered the public as a great improvement on all non-electric methods of cooking, as regards convenience, cleanliness, perfection of control, health, safety and quality of service given.

With a rate sufficiently low for cur-

1 A paper presented before the Jovian League of Chicago, December 1.

rent, the public can be offered something which is, for a large range of users, no more expensive than gas or coal appliances, and infinitely superior to them in results.

Given current at four cents per kilowatt-hour or less, electric ranges have an enormous field in which they can prove themselves to be the cheapest as well as the best.

Naturally, the lower the price at which current is offered, the stronger the competitive position of electric stoves and ranges, and the more numerous the service for which they can bid on grounds of economy alone. Naturally, too, as the market expands the manufacturers can lower their prices.

No set rule can be laid down on the subject of rates, but every central station must recognize the fundamental importance of cheap supply as an element in any serious attempt to build up a large cooking load. Local conditions vary tremendously. It is hard to find two central stations operating under the same conditions.

It is my firm conviction that rates for each class of service supplied by central stations should be framed with a direct eye to the conditions of commercial competition for that class of service, so that, as far as is practicable, competition can be met on the same basis, in so far as cost is concerned, leaving quality to turn the scale in favor of electricity.

The direct route to lower cost is by increasing outputs and load-factors. For every kilowatt-hour that is sold today for lighting purposes, the central station will ultimately sell from 10 to 20 kilowatt-hours for other purposes.

To put the case in a nut shell, never in its history has the central-station industry had such a magnificent opportunity as is now at its feet. The cooking and heating field is immense and vulnerable to attack at innumerable points. Take gas stoves alone, which naturally are our main point of attack, since what they can do we can do far better and in many cases more cheaply. We are better equipped today for attacking the gas stove and gas heater than we were seven years ago for attacking the gas light and gas engine.

And the spoils of victory will far transend anything we have secured in the past.

All that is needed to achieve early and tremendous results is vigorous commercial enterprise. A low rate and systematic canvassing, based on real knowledge of the subject, will bring results.

There is but one difficulty standing in the way—fear on the part of some central-station managers as to the effect of electric ranges on the distribution system. This deters some.

It has been a failing of our industry that we have never fully appreciated the strength of our own case or the weak points of our competitors. In the young days of lighting and power we always attached too much weight on what our opponents said. They said it so often and so loudly and so confidently, and besides, they had so long been in possession before we appeared, and were so wealthy and influential and middle aged, that we too often allowed ourselves to be abashed and shouted down.

It was the instrinsic superiority of our commodity that won most of our battles—not the way we wielded our weapons.

Let us realize that up to the present, cooking has been not only an unclean operation, but one depending on crude approximations and rule of thumb. The horrors of the coal range, with its soot, ashes, spatters of smoking grease, and an intolerable temperature, are gone, but most of the other forms of dirt and discomfort remain, with other obnoxious concomitants, such as copious fumes from oven and a nauseous reek that even frequent and laborious scouring only diminishes.

For the first time in the history of mankind, cooking at once clean and uniform, in the perfection of its results, is made possible, thanks to electricity.

Cooking with electricity is today the simplest possible process and the merest novice can produce perfectly cooked food by simply turning a few switches on and off, at stated times. That is one of the points, which, if our gas friends could claim it for themselves, would be used by them to sell gas stoves by the thousands.

If they had such a selling point they would be content even if their article was more expensive to buy and operate than our own and would do a large business on the score of quality alone—or if they could claim the benefits which we can offer the cook—no heat, smell or dirt, but perfect control and almost automatic production of ideal results—they would probably have organized a national strike of servants in favor of gas and clean hands.

Change in Service at Louisville.

Rapid progress is being made by the Louisville Gas & Electric Company in converting its power business from 500-volt direct-current to multi-phase alternating-current service. Practically all of the business has been placed on the latter basis, a recent change involving the plants of the Snead Architectural Iron Works and the Latham Hardwood Flooring Company.

Mr. Insull on Commonwealth Edison Rates and Policy.

In a recent interview, discussing the light rates passed by the Chicago City Council last week, Samuel Insull, president of the Commonwealth Edison Company, made the following interesting and illuminating remarks, which are taken from the Chicago *Tribune* of November 29.

"My point of view and the point of view of the Commonwealth Edison Company," Mr. Insull said, "is that rate making is an economic, not a political proposition.

"If we were discussing a contract ordinance simply on the basis of what might give the greatest reduction to the greatest possible number of customers at the moment, we would take an entirely different position from that we naturally take when discussing the proposition from the point of view as to what would be conducive in the long run to the lowest possible cost of energy, and consequently the lowest possible rates.

"At a time when, according to the reports of the city's experts, a very large number of the customers of the Commonwealth Edison Company obtain their service—even at the maximum rate—at a price lower than the actual cost, the question to be considered is how the rates can be adjusted so as to help reductions in cost, which reductions in cost must necessarily be followed by further reduction in maximum rates.

"The principal items in the cost of energy are interest and depreciation, and, looking at it from an economic point of view, and not from a political point of view, the problem to be solved is how to sell the most units of energy for a given investment—or, to put it another way, for a given amount of interest and depreciation.

"The more energy that can be produced for a given investment, the lower is the interest charge per unit, and undoubtedly the city expert, City Electrician Palmer, had this idea in view when he made his report, which was practically accepted by the Edison company.

"The last thing the Edison company wants to be guilty of is that of ignoring the desires of the city authorities chosen to protect the community. I do not consider that in insisting that this subject should be dealt with on an economic basis the Edison company took any such position.

"The best evidence that its method of charging for energy meets with general acceptance of the community is the fact that the Commonwealth Edison Company has more small customers than any company in the world and that it sells more electrical energy

than any two of the large companies in the metropolitan cities of the east.

"Chicago for years has been the Mecca of engineers engaged in the business of distributing electrical energy on account of its very low average rates, its average income at the present being lower than the average cost of energy in the metropolitan district of London. This result is brought about by the enormous massing of the production and distribution of energy in the city of Chicago as compared with the production and distribution in the city of London.

"As an evidence of this I would state that the total output of energy of all the companies in Great Britain and Ireland only exceeds by a slight percentage the output of the Commonwealth Edison Company.

"The necessity for dealing with this subject on the basis of a long time contract is owing to the fact that the stability of the enterprise should not be disturbed every year or so. During the period of the contract ordinance passed by the council on Wednesday the capital expenditures of the Commonwealth Edison Company probably will exceed $25,000,000. By capital expenditures I mean the money paid out for extensions of the distribution system and for building new plants entirely outside of operating expenses.

"This vast sum of money can only be raised at a reasonable rate of interest if the business is looked upon as stable and having ample earning capacity.

"Instead of the reductions of price put into operation by the Commonwealth Edison company from time to time as rapidly as the reduction of cost makes it possible being given as a reason for making a short-term contract, credit should be given the company for acting voluntarily and not under compulsion.

"As an evidence of the vast sums of money spent for extensions by the Edison company, I would instance that at the present time we are installing a plant which alone exceeds in horsepower the justly, much heralded hydroelectric development at Keokuk.

"We have been criticised for withholding data about our cost when, as a matter of fact, the technical journals of the country from time to time contain more information about the cost of production of the Commonwealth Edison company than about any other company in the country.

"My personal ambition is to produce the largest possible amount of energy at the lowest possible cost to the community. This can only be accomplished by producing it in very large quantities under conditions that enable us to sell it retail to the consumers of Chicago and wholesale to large users both in the city of Chicago and in the surrounding territory.

"We recognize absolutely that business of this character should be very closely regulated, but we believe the best results can be obtained by close co-operation between the company producing energy and the authorities regulating that company, rather than by making a political issue of the subject."

Rate Schedules.

In a bulletin sent out by the Department of Examinations and Reports of H. M. Byllesby & Company, Chicago, entitled "The Vital Need of Scientific Rate Schedules," it is stated that no one feature of public-utility operation is deserving of closer attention than the subject of equitable and profitable rate schedules. A scientific rate schedule is one which accomplishes these objects: (1) promotes the maximum development of the business; (2) promotes harmonious relations with the public; (3) avoids discrimination and is susceptible of logical explanation; (4) produces reasonable profit.

With the widespread vogue of utility-corporation regulation by state commissions, the necessity for intelligent rate-schedule review by experts representing the companies themselves has become urgent. Every service company in its own best interests should take the initiative and place itself in position to defend its theory and practice of charging for service.

Aside from the regulatory aspects of the question is that of commercial expediency. Proper but not necessarily higher rate schedules frequently mean large additions to gross and net income.

Meeting of Central-Station Employees.

The Boosters' Club of the public utilities of New Albany, Ind., which includes the United Gas & Electric Company, held its first fall meeting November 28, when the meeting was given over chiefly to a description of the new automatic interlocking electrically operated signal system recently installed on a four-mile section of the Louisville & Northern Railway & Lighting Company's line between Watson Junction and Sellersburg, Ind. The use of the system is to be extended as rapidly as possible.

A quarterly meeting of the employees of the traction lines associated with the electric company was held in New Albany, December 1, for the discussion of accident prevention. James Harmon, claim agent of the road, whose title has been changed to "safety agent," indicating the new and enlarged duties of the position, made the principal address.

Record Output for Commonwealth Edison Company.

The unusual weather conditions of the past 10 or 12 days in Chicago, during which time a dense pall of smoke and fog hung over the city, has caused the kilowatt-hour output of the Commonwealth Edison Company to exceed any previous output. Wednesday, November 26 was the darkest day in the history of the city and all stores, offices, signs, etc., were lighted all day. The company's output on this day was 3,500,000 kilowatt-hours, but this figure was exceeded on November 11 when the output reached the imposing figure of 3,538,000 kilowatt-hours. While the latter day was not so dark as on November 26, the street-car heating load accounts for the greater output. The company estimates that should heat have been required on November 26, the output would have exceeded 3,700,000 kilowatt-hours.

Central-Station Company Supplies Railway.

The Scranton Electric Company, of Scranton, Pa., has closed a 20-year contract with the Scranton Railway Company to furnish power for operating the cars of the latter. Beginning with this month only a small portion of the power requirements of the railway company will be supplied, but this will be increased from time to time until the whole system is supplied from the power plant of the central-station company.

Meeting of Commonwealth Edison Section.

The first get-together meeting of the Commonwealth Edison Section, N. E. L. A., under the new admistration, was held on Tuesday evening, December 2, in the Insurance Exchange Building. Various entertainment features were provided and refreshments were served. George B. Foster was chairman of the Entertainment Committee having the affair in charge.

Production of Tungsten Ore for 1912.

The production of tungsten ore in the United States during 1912 was equivalent to about 1,330 short tons carrying 60 per cent of tungsten trioxide, valued at $502,158. The output for 1912 was larger than that for 1911, when 1,139 tons, valued at $407,985 were produced. The total amount of tungsten produced in the world in 1912 was 9,115 short tons.

Electrical Construction

CONDUIT WORK IN A FIRE-PROOF BUILDING.

An Installation of the Universal Conduit System.

One of the most difficult problems encountered in designing the electrical work in buildings of certain classes is that of selecting the best locations for the ceiling outlets. And after the best that is possible along this line has been done it is often necessary, when the building is ready for occupancy, to add new outlets or to change the locations of some of those already installed. Moreover, such revisions of the wiring are quite liable to be troublesome to make in a manner that is satisfactory. To take a specific example, consider the modern type of fireproof office building. The requirements of the tenants on any floor of such a building can hardly ever be fully anticipated while the wiring is being done; the work can only be laid out to meet their probable needs, and then when the arrangement of the offices is definitely known, important changes in the location of the ceiling outlets may be found to be desirable. Thus, at best, it becomes necessary to do more or less of objectionable cutting and patching in the ceiling. This process is expensive, and if the work is not done by skilled workmen the ceiling structure may even be materially weakened.

Fig. 1.—Conduits and Junction Boxes in Ceiling.

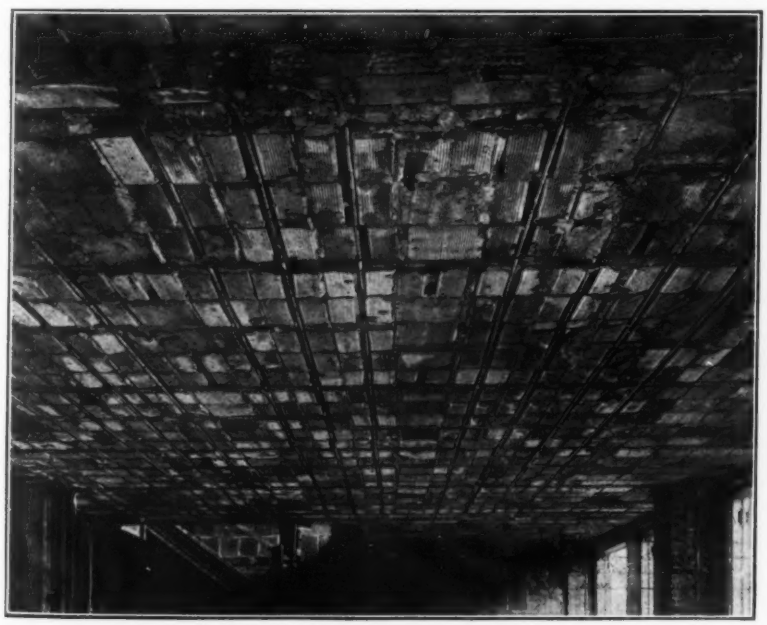


Fig. 2.—Unfinished Ceiling With Conduit in Place.

Having realized the foregoing difficulties, from experience in the construction field, a firm of electrical contractors in Chicago developed a new and very interesting system of concealed conduit construction, not long ago, the principal object of which is to provide new lighting outlets in a building without the necessity of resorting to any objectionable cutting of ceilings and floors and the consequent patching of the plaster. This is known as the Universal Conduit System, and the first installation of the kind is now being completed in one of the large fireproof office buildings in Chicago.

Characteristic features of the construction under consideration consist in the fact that the conduits for the accommodation of the ceiling outlets are placed in the ceiling just above the plaster, and that, by means of a tool designed for the purpose, an outlet can be readily installed at any point in a run of conduit after the ceiling is finished, without the necessity of cutting a hole in the plaster larger than can be covered with a fixture canopy of the usual size. In fact, ceiling-outlet boxes will not be installed on

any part of the job until the space on the various floors is rented and the tenants specify where the outlets are wanted.

The Webster Building Addition, in which the system is being installed, is a 12-story-and-basement fireproof structure with tile floor arches. The National Fire Proofing Company made a special grooved tile block and soffit tile for this building, the cost of which, it is claimed, was no greater than that of standard tile. In one or two instances when the tile setters ran out of the ordinary tile, the conduit was spaced to set in the seam between the arches, which demonstrated that this method is also practical, though not so desirable as the special tile.

The conduit was installed 13 inches center to center, almost throughout the ceilings (which is the maximum Universal layout), and was laid on the centering, or temporary planking, used by the fireproofing. The conduit hangers, which hook around the pipe and clamp to the flanges of the I-beam, were then set in place and locked up tight, securely holding the conduits in their exact positions. One end of each conduit run was closed with a gas cap, and the other end terminated in a small junction box. With only two exceptions on each floor, each junction box was the terminal for one end of each run in two adjoining offices. These boxes are approximately 6 by 8 inches, and are provided with a plaster cover with a 4-inch round opening in the center. This is all concealed, as are the conduits, by the plaster. A round flat cover is provided for the opening in the plaster cover, which is drilled for screws and countersunk so that when installed it protrudes only the thickness of the metal below the finished ceiling. When painted over this cover is not noticeable, though as a hand-hole it allows access to the wires and connections from all conduits terminating therein.

These boxes and conduits are flush with the bottom of the tile and are concealed only by the plaster. The home runs from the junction boxes to the panel cabinet are one-inch conduits over the top of the tile, as is present practice. For greater flexibility all junction boxes are interconnected with one-inch conduits; an idea of this flexibility may be obtained from the fact that a switch in the northeast corner of the floor can be connected to a fixture in the southwest corner without touching the plaster. The junction boxes replaced troughs which it was originally intended to use.

Switches and receptacles are being installed in columns and outside walls only, where they cannot be covered by future partitions.

A valuable feature made possible by this system as installed in this building is that all receptacle outlets in outside walls are connected with half-inch conduit. This allows the installing of a receptacle anywhere on this pipe at any time during the life of the building. All switch legs terminate in the junction boxes, and at this point may be connected to any or all conduits in the room.

Figs. 1 and 2 show portions of the ceiling before the plastering was done. The method of running the conduits from the junction boxes is brought out very clearly in Fig. 1.

Fig. 3 is a working drawing of the conduit construction in a portion of the ceiling. The conduits are marked *A*, *B*, *C*, etc. Dotted lines show how the junction boxes are interconnected, while the dotted line extending to the right from the junction box in the upper right-hand corner of the figure indicates the circuit from the wire shaft containing the risers from the service board in the basement.

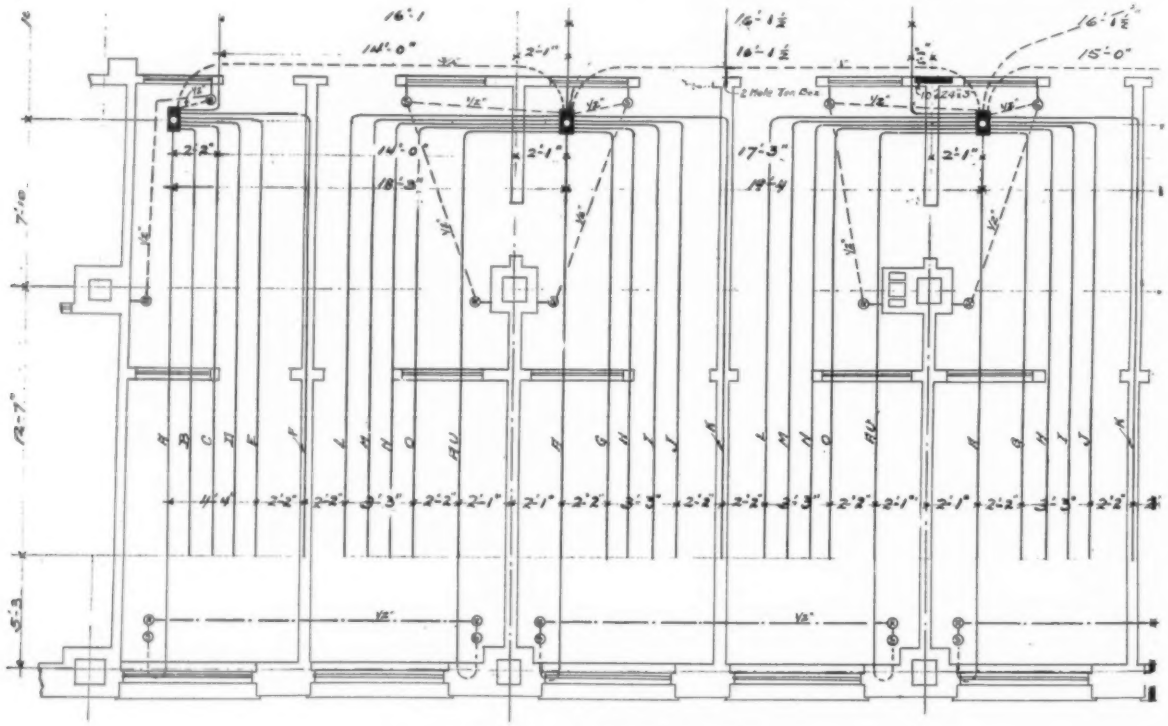


Fig. 3.—Typical Layout of Conduits in Ceiling.

Outlets will be provided by milling out the lower half of the conduit with a special milling machine and fastening a conduit-outlet box to the pipe with *U*-bolts, the box and bolts being of special design.

The Universal Conduit System Company claims that the conduit can be milled out without disturbing the conductors and that no rough edge or burr will be left at the opening to injure the insulation.

The work in the Webster Building Additions is being installed by the A. M. Wilmersdorf Company, electrical contractors, of Chicago.

Faulty Wiring.

The editorial in our issue of October 25 entitled "A Remedy for Faulty Wiring," has brought forth some comment from a writer in our British contemporary *Electrical Industries and Investments.* He corroborates the statement that the disposition to explain poor work on the assumption of ignorance or viciousness on the part of the contractor or his representative is by no means always just or well founded. The following paragraphs are quoted.

"While there are things which might justify the sacrifice of life, of course, the statement is near to the truth that for his life a man will surrender everything else. And the desire for continued existence on the part of the electrical contractor is no less keen or reasonable than is this desire on the part of any other mortal. When he has had to take contracts at starvation prices in order to get them at all, it is little wonder if, to save himself, he has sometimes skimped the job where he conveniently could. Nobody would contend that there are not wiremen who do not know how to install good work, and the field is not free from electricians and contractors whose conceptions of honesty are somewhat awry; but the insistence on low prices for wiring has been the most effective of all the causes of shoddy construction.

"The remedy for faulty wiring suggested in the foregoing is apparent; it is perhaps the only one that can ever be depended upon to become generally very effective. The education of the contractor in the matter of prices, and, through him and the electrical inspector, the education of the public as to the value of good electrical construction, is the thing to be promoted and encouraged. It is most pleasing to note that the problem of better and safer electrical construction is now being approached from just this angle. Supplemented by the growing practice of requiring electricians to be licensed, the present activity of the associations of electrical contractors in teaching their members to compute costs properly and to insist upon reasonable prices is bound to mean much for improvement in electric wiring practice in this country. This is the source from which betterment is to be most expected."

The writer then comments as follows:

"Admitting the sanity of the above quoted remarks, what do we find on applying them to the condition of things obtaining in this country? It is asserted that the contractor must be educated in the matter of prices; that he must be taught how properly to compute costs, and so on. Very good indeed. On more than one occasion in these columns I have directed the attention of the British Electrical Contractors' Association to the importance of the question of costs. I have suggested that the Electrical Contractors' Association should devote itself to this question as a very useful piece of constructive work, and I have directed attention to the example afforded by the printing trade in which the most strenuous efforts are being made to emphasize the importance of proper costing to the end that individual printers might abandon the practice of accepting work at unremunerative prices. At the same time, while laying all possible stress on the importance of costing, it must be kept in mind that the electrical trade labors under peculiar disadvantages. The printer has to deal only with other printers in competition with himself, and his client. On the other hand, the contractor has to deal with competing firms, with his client, and with the central station authority. And I am not committing myself to a falsehood if I say that the latter factor in the situation is a very important one, and is one, moreover, that has operated very materially in bringing prices down to an unremunerative level and in fostering the poor construction work with which we are dealing. Some there will be who will jump to the conclusion that I am going out of my way to administer another kick on the posterior of the central-station engineer. But as a matter of cold fact I am doing nothing of the sort. I will go as far as to say that to desire the cheapest possible type of construction work is a perfectly natural feeling on the part of those in control of supply undertakings. Logically, "Consumers First" must be their subconscious motto. If electrical installation work cost nothing, the rate of connection would be exceedingly high, and, in the same way, as the cost of installation mounts upward so also will the rate of connection tend to slow down.

"Hence it comes about that the central-station engineer must be persuaded to recognize the value of good work before it is possible for the contractor to assist in the abolition of shoddy work. And the central-station engineer must be persuaded to recognize that good work necessitates a good price being charged for it, the said good price carrying with it not only a good but substantial margin of profit. The difficulties in the way of the effective preaching of such a gospel are, however, not to be underestimated. The central-station engineer carries on a large, wholesale business on a relatively small margin of profit, and he fails to put himself in the position of the contractor who is carrying on a small retail business necessitating a much larger margin of profit. It is this simple fact which has accounted, more than anything else, for the failure of municipal wiring and sales departments. Run for the sole object of obtaining connections, these departments have been operated on too narrow a margin of profit, with the result that they have been closed down or they are supported by the profits made on the large wholesale side of the business—i. e., by the relatively small margin of profit made on the supply of current. And not only is such bolstering up of a wiring department grossly unfair to independent wiring concerns in the same district, but the whole scheme tends to reduce wiring to an unprofitable level, and actually to foster bad competitive work. Hence, one comes to the conclusion that the elaboration of cost systems is not a bit of use in the wiring world until the industry as a whole, and central-station engineers in particular, express themselves as willing that installation practice should be put on a higher plane and that reasonably substantial profits shall no longer be regarded as a crime or as an obstacle in the way of electrical progress.

"The space at my disposal is, I fear, running out. But one thing remains to be said. The ELECTRICAL REVIEW AND WESTERN ELECTRICIAN refers to the licensing of electrical contractors as a factor tending to the elimination of the shoddy worker and to the general improvement of wiring practice. It may be that, in time, we, in this country, may see our way to the official recognition and licensing of members of the installation trade. Meanwhile, however, the strenuous efforts being made by the leading spirits of our own Electrical Contractors' Association, in the matter of their guaranteed wiring scheme, are deserving of recognition by the industry at large. British electrical contractors are making an effort to work out their own salvation, and in this matter they should have the very lively support and encouragement of every electrical onlooker."

To Standardize Small Appliances.

The Incorporated Municipal Electrical Association (England) has appointed a subcommittee to deal with the question of the standardization of plugs and other small appliances in common use by the general public. A. C. Cromb, borough electrical engineer of Croydon, London, is secretary of the committee.

Among the Contractors.

Leroy Stewart, successor to Stewart & Jansen, has been awarded the contract for wiring the new building of the Young Men's Christian Association in Gloversville, N. Y.

H. E. Walker, member of the firm of Walker & Walker, electrical contractors of Toledo, O., was recently accosted by two young men while alone in his store at 118 North Erie Street. One of the strangers approached and asked to be shown some search lights. At the first opportunity he drew a revolver and leveling it at Mr. Walker's head, marched him to the rear of the store and ordered him to open the safe, which was, however, already open. As the robber stooped before the safe Mr. Walker knocked him down, his pistol dropping from his hand. This unexpected attack broke up the plans of the thieves and they made a hasty departure. This is the fourth time that burglars have entered the Walker store and the previous trips proved more successful, several hundred dollars' worth of goods having been taken.

The Bland Electric Company, of Louisville, Ky., has completed the installation of the electric wiring in the new building of the Southern Motors Company, of Louisville.

H. A. Hynes, electrical contractor of Chester, Pa., has just completed the installation of a complete electrical plant at the Delaware River Terminal of the Texas Oil Company. Other jobs nearing completion are the electrical work in the new plant of the United Roofing Company in Chester, consisting of about 500 lamps and 25 two-phase motors totalling about 200 horsepower, and the installation of a two-phase equipment at the South Chester Tube Company which includes 100 500-watt lamps and about 350 horsepower in motors.

The White City Electric Company, of Chicago, is wiring a building on South California Avenue, Chicago, for 600 lamps and 60 motors.

A. S. Schulman, of Chicago, has the contract for wiring the Ft. Dearborn Hotel, in Chicago, this being a new building now in course of erection. There will be 5,000 incandescent lamps and a number of electric motors.

The Pierce Electric Company, of Chicago, is wiring a building on South Desplaines Street, Chicago, for 1,500 lamps and a number of motors.

Among the large electrical installations under way in Philadelphia by the United Electric Construction Company is the work in the New Adelphia Hotel.

The Beltzhoover Electric Company, of Cincinnati, O., has been awarded the contract for the electric-light wiring in the new chapel to be erected for the trustees of the German Protestant Cemetery, in Cincinnati. This will be a conduit job throughout, and all outlets will be controlled directly from the panel-board. This company has also secured the contract to install the electrical work in a number of apartments in some apartment houses owned by the Oriz & Alta Company, in Cincinnati. These buildings were erected years ago, before the days of electric lighting, and are massive brick structures. Most of the interior walls are of brick and are either 13 or 17 inches thick. A job that the Beltzhoover company has just completed is the wiring for light and power in the five-story building occupied by Montford & Company, publishers, at 420-422 Elm Street, Cincinnati. Individual-motor drive and lighting with tungsten lamps are employed throughout the plant. Owing to the fact that the conditions were such as to necessitate locating the meters on the fifth floor and feeding from that point, this was an unusual installation. The Beltzhoover Electric Company conducts a first-class retail store in addition to its contracting department. It reports that business is good.

Kohler Brothers, of Chicago, have secured the contract for the electrical work in what will be one of the largest church buildings in this city.

The electrical work in the James Hunt Building, in Chicago, will be installed by L. K. Comstock & Company, of this city. There will be about 5,000 lamps and some 75 horsepower in motors.

The Fisk Street station of the Commonwealth Edison Company, of Chicago, is being wired by the Beaver Electric Company, of this city, for 1,000 incandescent lamps, 10 arc lamps and 62 motors.

Electrical Inspector for Louisville.

The duties of the gas inspector of Louisville, Ky., are to be enlarged so as to include tests of electric circuits, examination of meters and adjustments of complaints, according to announcement from the city administration, which is having an ordinance covering the work of the official drawn up. The gas inspector heretofore has occupied what is regarded as a practical sinecure, the duties of the office being few in number. The salary is $1,800 a year at present, but on account of the increase in the work, and the necessity for the appointment of a technically trained man, it is stated that the salary will be increased.

Waterproof Concrete.

Results of great importance to contractors and engineers who have to do with concrete construction are being obtained in a series of tests to determine the rate and the amount of flow of water through concrete. The College of Engineering of the University of Wisconsin is making these tests with the object of finding a simpler means of making concrete water-tight. A large cement company in the middle West is cooperating with the College by offering the facilities of its plant for these experiments.

Already some interesting results have been obtained as to the effect of the length of the time of mixing in a machine mixer of the batch type; the effect of the percentage of mixing upon the imperviousness of the concrete; the effect of having sand in dry condition before mixing; and the effect of having the sand wet.

The experimenters have found that good results are obtained if the concrete remains in the mixer from two to three minutes when dry materials are employed. For cases where the sand and gravel or stone are damp a considerably longer time is required. Therefore the use of wet sand should be avoided if possible. The experiments showed that mixtures consisting of 2 parts of cement, 3 parts of Janesville sand of the Torpedo grade, and 6 parts of Janesville gravel, when mixed to a wet consistency, are impervious to water when subjected to a pressure of 40 pounds per square inch. Mixtures as lean as 1 part of cement to 6 parts of gravel (a graded mixture) have been made impervious at high pressures by using care in proportioning the amount of water and in mixing the batch. The specimens used in making these tests are cylindrical in form and so made that the faces of the cylinders, which are 13.5 inches in diameter, are exposed to the predetermined water pressure. The thickness of the concrete through which the water must pass can be varied from 4 to 18 inches. Ample provision is made for cleaning both faces of the cylinder before placing it upon the testing apparatus. The apparatus itself is so arranged that very accurate tests can be made.

The importance of these experiments will be appreciated when it is understood that a large proportion of the trouble arising from poor concrete is due to the use of defective sand or gravel.

The department is also studying the effect of varying the percentages of cement and water, the gradation of the sand and gravel (by this is meant the size of the rocks and the fineness of the sand), the proportioning of the mixture, the thoroughness of mixing, and the effects of different conditions on the hardening of the specimens.

National Association of Electrical Inspectors.

THOMAS HENRY DAY, president, 59 Deerfield Street, Hartford, Conn.
H. S. WYNKOOP, vice-president, 13 Park Row, New York, N. Y.
WILLIAM LINCOLN SMITH, secretary and treasurer, Concord, Mass.
JAMES E. COLE, Representative on Electrical Committee of National Fire Protection Association, 11 Wareham Street, Boston, Mass.
J. E. LATTA, assistant secretary, 608 South Dearborn Street, Chicago, Ill.

Executive Committee

EUGENE N. DAVIS, chairman, Brookline, Mass.

Frank R. Daniel, R. P. Strong, Henry A. Knight, C. H. Fletcher
Washington Devereux, James B. McCarthy, James H. Fenton
R. J. Forsyth, C. W. Mitchell, A. W. Hopkins, G. W. Perry
George L. Collison, T. H. Fritts, A. H. Soper
T. W. Bowry, F. G. Hartwell, A. A. Moffitt, Thomas D. McColl

Secretary's Message.

The British Columbia Section No. 1 has chosen H. Burns, chief inspector of the Municipality of Burnaby, as its second representative on the Executive Committee. Mr. Burns's address is Edmonds Postoffice, Burnaby, B. C.

Secretary Cook reports that the Section has started a question box, open for deposits from any one interested, and that the matters found therein furnish material for plenty of discussion at the meetings.

Ralph G. Hudson, instructor at the Massachusetts Institute of Technology, has been elected an associate member.

Maurice E. Bates, city electrician, Kansas City, Mo., has been elected to active membership, as has also C. M. Harman, of 271 Broad Street, Elizabeth, N. J., who is an inspector for the Underwriters' Association of the Middle Department.

The Massachusetts Association of Municipal Electrical Inspectors has been elected to section membership, and therefore becomes Section No. 2, National Association of Electrical Inspectors. The local officers are Eugene N. Davis, Superintendent of Lights and Wires, Brookline, Mass., president; W. L. Smith, Inspector of Wires, Concord, Mass., secretary; Eugene N. Davis and Henry A. Knight, Supervisor of Wires, City of Worcester (Mass.), representatives on the Executive Committee, National Association of Electrical Inspectors.

The Association has 27 members, of whom 18 were already members of the National Association; so the net gain in membership is 9. The local meetings are held monthly, usually at the office of the Commissioner of Wires in Boston, it being very central, but also frequently with other members, especially when visits are made to power plants, factories or other places of electrical interest in the various municipalities. The meetings are very interesting, helpful and well attended. The membership is drawn mostly from the eastern part of the State.

A meeting is to be held in Springfield, Mass., at the office of Executive Committee Member Hopkins, on December 8, under the auspices of President Day, for the purpose of organizing a Western New England section; the idea has been very enthusiastically received by the inspectors in that territory and a very inspiring meeting is anticipated.

The matter appearing in this section consists of questions on the National Electrical Code, its interpretation and meaning, and questions as to whether certain methods of wiring are in accord therewith. These questions are gladly received from anyone interested, even if not a member; they should be sent to the secretary with any needed elucidating sketch. They are answered by each member of the Executive Committee according to his knowledge of what the ruling would be in his jurisdiction.

It should be understood that no pretense is made to give an authoritative interpretation of the Code. This is a voluntary association; it has representation on the Electrical Committee of the National Fire Protection Association, which prepares the Code, but it has no right, and claims no right, to give a final interpretation of anything in the Code. It is only intended to give the interpretation which seems correct to the members of the Executive Committee. No attempt is made to edit or correlate the answers from the different members of the Committee, as it is felt that the occasional difference of opinion is calculated to lead to a further study of the matter in question, further discussion and the final clearing up of obscure points.

The aim is to help toward a better understanding of the Code on the part of all; a more uniform conception of its meaning; increased precision in applying it; and harmonious action of those using it, for the common good.

The Secretary regrets to say that in some way the answers to questions 240, 241 and 242 (which appeared in the issue of November 15), received from one of our most valued members were in some way mislaid and have only just come to light; they are presented below, with humblest apologies on the Secretary's part for his carelessness.

In regard to the questions appearing in this issue little need be said: question 245 is the only one to which it seems necessary to call special attention.

As this came to the Secretary it read: "In a four-wire three-phase 220-110-volt system, with grounded neutral," etc. The Secretary was in doubt just what was meant when he came to use this question. If the circuit was Y-connected, with the center grounded, and lamps connected from each line to the center, one might get 110 volts across each lamp, but from line to line there would be 110 times 1.732, or 190 volts. Another plan sometimes used is the delta connection, with 220 volts between lines, and the center of one leg of the delta tapped out, which gives a straight 220-volt three-phase delta circuit for motor work and makes it possible to take off lamps from one leg as from a single-phase three-wire 110-220-volt circuit—barring some disturbance between phases and the fact that the tapped phase reaches full load before the other two. This is a four-wire system with a neutral, so far as the lighting load is concerned.

The Secretary wrote out the question rather hurriedly as it appeared in the list, but he now feels that what was intended was really the straight Y-connection with grounded wire carried out for a neutral and the separate phases each operated as a single-phase three-wire lighting circuit—two 110-volt lamps in series across each leg with the neutral tapped in between the lamps. Here at first glance, as each lamp will show 110 volts, we have what might be called 110-220-volt circuit, but if the neutral is momentarily disconnected from the center of the Y-connection there is found only 190 volts across the two lamps in series, which of course is not the case in a straight three-wire system. It does not make any difference as to the nature of the answers to the question, however, because no authority can be found in the Code for running the neutral wire there.

It is sometimes said that in a conduit system the neutral might as well be run bare, because the conduit is grounded on the water pipe and the neutral is grounded on the same pipe and therefore the value of insulation is questionable. However, where the run is brought out of the conduit, insulation would be necessary; otherwise

there would be a much larger possibility of getting short-circuits while wiring up fittings or making changes in the wiring.

Again, with the bare neutral in a conduit, both grounded, there is a marked tendency for the current in the neutral to divide between the two parallel paths, and as the conduit has a considerable cross-section it may take quite a large proportion of the current; if the load is unbalanced this may be considerable, and then we are straight on the road to: reactive drops due to the current in the iron conduit, energy loss due to eddy currents and hysteresis in the iron, and consequent heating of the conduit possibly to a dangerous extent. One would hardly dare say just what would happen in any particular case, but the possibilities are obvious and unpleasant, so that in any case the rule, and particularly as applied to alternating circuits, is a good one and fully justified.

Vice-president Wynkoop has prepared a brief article upon our new line of work, which is here presented.

Section Membership.

In each community, or cluster of communities, there are a number of persons engaged in the electrical inspection service who have enough enthusiasm for their vocation to feel the need of getting together with their coworkers and exchanging ideas. Many of these men are members of national or semi-national associations, through which opportunity is afforded them by means of annual conventions to compare notes with their fellows and thus *regain* touch, once a year, with the trend of thought which is responsible for the current requirements of the National Electrical Code.

In our own association persistent effort has been made for some years to *keep* our members in touch with each other and with current electrical code thought through the bulletin of the association, which appears bi-monthly in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN. This effort has met with a considerable measure of success and is undoubtedly of great value to those members who use it.

Compared with the large field upon which we have to draw, the present membership in our association is very meager. This result, I take it, is not due to lack of interest on the part of inspectors themselves, but rather to some past failure on the part of our association to meet the real need of the inspectors.

In surveying the methods of sister associations we find that all of them have apparently come to believe that their greatest usefulness can best be brought about by the establishment of local sections, each section covering a territory compact enough to enable the members to get together, at least bi-monthly, for the interchange of experience and advice.

We too have adopted this idea; have revised our Articles of Association accordingly, and are ready to welcome section membership.

We feel that the new section idea should appeal strongly to all eligible persons. Here we have centralization under the officers and executive committee for purposes of uniformity and general control, and decentralization for purposes of detail administration and intimate conference. Any group of men in any locality may now bind themselves together as representatives of the electrical inspection service and apply to the national body for section membership; and, if their request is granted; they may have full assurance of the hearty support, not only of the national association, but of all other sections of the association. Thus each inspector may feel that he is a spur in the gear of the national machine instead of being merely one point of a little local pinwheel.

I apprehend that there are comparatively few localities where there will be any necessity for the organization of a new body which shall ultimately become a section. The get-together idea is so strong in this day and generation that go where you will you will find inspectors getting together bi-weekly, or monthly, or bi-monthly, perhaps in the rooms of the local electric light company, perhaps in the rooms of the Underwriters, perhaps at some club or restaurant—but always getting together at regular intervals for the interchange of experience and advice.

Some of the groups are regularly organized, others not, but in every case where such a group can be found it will undoubtedly prove the logical nucleus of a geographical section of the National Association of Electrical Inspectors.

We offer to these nuclei membership in a national body. We agree to supply them with the official organ of the National Association. We promise to use every reasonable effort to interchange latest thoughts on the National Electrical Code, so that no member may feel that he is too far removed from the center of activity to keep posted on Code requirements and interpretations. We commit ourselves to the idea of local autonomy so far as this does not diminish the weight of authority which the National Association must possess in order to retain its influence.

And now we shall wait to see whether the continued and earnest thought which the officers and executive committee or our association have so faithfully devoted to the development of ways and means is destined to bear fruit in the shape of applications for section membership.

H. S. Wynkoop,
Vice-president.

Answers 11 (B) to Questions 240, 241, and 242:

Question 240. Should it be considered permissible to install single or double-strip flexible metallic conduit in chases cut in dry brick walls, assuming that rigid metallc conduit would be used wherever found possible on the job?

Answer. An approved flexible metal conduit may be used under conditions referred to.

Question 241. Code Rule 30a, second paragraph, requires the protection of gas pipes above the insulating joint at fixture outlets. Should any exception to this be allowed by the inspector in the case of a conduit installation, where the entire box inclosure is a grounded surface, and where consequently the utility of the prescribed protection might be questioned?

Answer. Irrespective of the merits of the question, the rules call for protection to gas pipes above the insulating joints by means of approved insulating tubing, without regard to what type of construction the installation consists of.

Question 242. Does Rules 38t, third paragraph, prohibit the placing of the service switch and cutout in any other place than the lobby or front of the house, provided there is a controlling switch in the lobby?

Answer. In Rule 38*t*, third paragraph, it is not the intention to prohibit the placing of service switch and cutout in any suitable location, even though it be not in the lobby or front of house. While the service switch does control the emergency lights, as well as all other portions of the electrical installation, it is only supposed to be used in special cases, and is not considered as a controlling switch under the meaning designed to be conveyed by the rule referred to. The rule intends that excepting the service switch, which it is not intended shall be used except as noted above, there shall be but one control, and that control shall be located in the lobby or front of the house; the obvious reason for this requirement being in the interests of safety to life.

Conduit Work and Wooden Cabinets.

Question 243. Rule 70b states that wooden or composition cabinets must not be used in an armored-cable, metal-conduit or metal-molding systems. In view of this rule, should the inspector permit, for instance, an additional circuit run in conduit from an existing wooden cabinet, the wiring already installed being run knob-and-tube?

Answer 1 (S). I think that Rule 28*d* will cover this case. I should use an approved fitting having separately bushed holes, within the cabinet.

Answer 2 (J). A single circuit of conduit wiring added to an existing system of porcelain knob-and-tube construction need hardly be construed as a conduit system under this rule. We should permit the conduit circuit to be carried into the wooden or composition cabinet, but would require that it end in a condulet or similar fitting within the cabinet, as if open on the wall. If there is not sufficient room in the cabinet to accommodate such a terminal fitting, the conduit should not enter the cabinet, but should end in a junction box or condulet adjacent to it, the wires then to enter the cabinet in flexible tubing.

Answer 3 (U). To comply with the rules, the conduit system would have to be changed to cleat or knob-and-tube construction before entering the cabinet.

Answer 4 (F). Yes, if this extension was made in accordance with Rules 27, 28 and 29 of the Code.

Answer 5 (Q). Rule 70 is intended to cover new work and should not be applied to a change as stated in the question; a device placed on end of conduit to seal the tube and support the wire in a wood or combustible cabinet would justify an approval.

Answer 6 (P). Yes; the Code is not naturally retroactive, and it would seem unreasonable to require the substitution of an iron cutout for the present wooden one; which would have been allowed to remain had no additional work been installed.

Answer 7 (B). In cases of this kind, where an additional circuit is run in conduit to an existing wooden cabinet, we have the conduit after entering the cabinet terminate in an approved device, the wires leaving it being properly separated and properly insulated from each other. As we are all aware there are several fittings which would fulfill these conditions.

Answer 8 (I). Yes; if the conduit is properly grounded.

Answer 9 (N). Yes; just how the conduit should terminate would depend purely on the conditions of each individual case. Thus it might be possible to let the conduit enter the cabinet and end within at a terminal fitting from which the wires would emerge properly spaced and mechanically separated; again I have seen cases where the distance from the cabinet wall to cutout was not great enough to allow this, and in such a case I should permit the conduit to terminate in a simple bushing, considering the fact that the shortness of the space, the immediate ending under the screws of the porcelain cutout and the protection of the wire by the side and front door-frame casing would prevent any possible disturbance of the wires which in ordinary cases we are afraid of; that is, I should consider these wires in practically as safe a condition as though they were inside an iron-walled box with equal short spacing. This is, of course, one of those conditions which we frequently meet in towns, especially in small houses, where the space for the cabinet was skimped originally and a new circuit like this is pulled in for a flat-iron and a washing machine in the kitchen, frequently up from the cellar near the pipes.

Sometimes it is better to put the conduit terminal fitting outside the cabinet wall and enter just like knob-and-tube work, through properly spaced and bushed holes. My contention above refers to conditions where this again is not possible.

Answer 10 (E). Under the conditions mentioned I would suggest that a terminal fitting of approved make be installed on the end of the conduit near the cabinet, if the conduit were exposed, and would have the wires enter the cabinet through separately bushed holes. If the cabinet were concealed, I would have the conduit enter the wooden cabinet, which while contrary to the Code, would not introduce any hazard.

Answer 11 (Y). Yes; provided the circuit in conduit was installed according to Rule 28. Our interpretation of this section is that it applies to cabinets on complete conduit systems, and under conditions described we would approve additional circuits in conduit. However, in this territory local regulations require all cabinets to be of metal.

Answer 12 (M). Yes, this could be permitted if the conduit were properly equipped with approved terminal fittings.

Answer 13 (R). Inspectors should not allow additions to old wiring unless the new wiring is installed according to the National Electrical Code.

Answer 14 (V). The location of the cabinet and the condition of the old wiring would determine my ruling. Existing conditions being good, I should allow it.

Answer 15 (O). Wooden or composition cabinets are not approved on conduit systems, but no rule of the Code could prohibit the use of cond it to inclose one or more circuits from such a cabinet, provided the conduit is installed in full compliance with the rules. For instance, the circuit in conduit could be terminated in a condulet or other approved fitting, either outside or inside of the cabinet, and the wires from said fitting carried to a branch cutout in an approved manner. In this case the conduit would be properly installed whether a cabinet were used or not, and the addition of a cabinet to inclose the cutouts, etc., would not introduce a violation.

Use of Bare Wire for Neutral in Four-Wire Three-Phase System.

Question 244. In a four-wire, three-phase, 220-volt system with grounded neutral, would it be permissible to use an uninsulated neutral conductor? If permissible, what method of construction should be used? What if the voltage were 110?

Answer 1 (S). No; this conductor should be insulated whether the voltage be 110 or 220.

Answer 2 (J). The National Code does not recognize bare-wire construction for either 110 or 220-volt work. I believe the question of permitting the grounded neutral to be run bare has been considered by the Electrical Committee, but that was not approved.

Answer 3 (U). No; the Code requires all wires to have an approved insulation.

Answer 4 (F). Insulated wire should be used in all cases.

Answer 5 (Q). No; it should have the same insulation as the wire of other parts of the circuit, in case of either voltage.

Answer 6 (P). Even if it could be shown that the neutral was always at zero potential with reference to other

grounded objects, still the Code would require the same insulation on this wire as on any other wire of the system.

Answer 7 (B). An uninsulated neutral conductor would not be permissible.

Answer 8 (I). See Rule 12*a*. We do not recall any Code rule that sanctions the use of bare wire in the way this question seems to contemplate.

Answer 9 (N). Nothing in the Code can be interpreted to allow the use of a bare neutral, in general wiring work.

Answer 10 (E). Section *c*, Rule 15, reads: "When the ground connection is inside of any building or the ground wire is inside of or attached to any building (except central or substations) the ground wire must be of copper and have an approved rubber insulating covering." This would appear to answer in a definite manner both parts of this question.

Answer 11 (M). Rule 15*c* of the 1913 Code states that rubber-covered wire must be used, and the rules following this define how it shall be installed.

Answer 12 (R). Rule 15*c* states that the ground wire must be of copper and have an approved insulating covering. Therefore I do not think it would be permissible to use an uninsulated wire for a neutral. This rule applies to any ground wire within a building, whatever the voltage.

Answer 13 (V). No.

Answer 14 (O). The use of an uninsulated conductor as part of an electric light or power system is not sanctioned by the Code.

Proper Fusing of Sign-Lighting Transformers.

Question 245. On low-voltage transformers for tungsten sign lamps are fuses needed on secondary circuits if the primary is fused for 12 amperes or less?

Answer 1 (S). Yes. Rule 83*g*.

Answer 2 (J). No.

Answer 3 (U). The secondary should be fused. The transformer stops the current up as much as it reduces the voltage.

Answer 4 (F). Yes; if the secondary pressure is 10 volts or more, each group of lamps that requires as much as 12 amperes should be protected by a double-pole cutout.

Answer 5 (Q). No.

Answer 6 (P). The sign rule No. 83 permits 1,320 watts on a final cutout. If, as in this case, the output does not exceed 1,320 watts, there is no reason for fusing the secondary circuits.

Answer 7 (B). Under the rules secondary circuits should be protected by fuses.

Answer 8 (I). Twelve amperes at 110 volts would mean 120 amperes at 11 volts. We can easily imagine an arrangement of circuits which would be dangerous. This is one of those cases where an inspector would have to use his judgment as to whether the secondary circuit could be overloaded without blowing the primary fuse.

Answer 9 (N). Suppose there was a 110-volt primary feeding a transformer having a ratio of 10 to 1, and that the rated full load for the primary was 12.5 amperes. This primary could be fused with a 12-ampere fuse, which fuse would be rated to carry 12 plus 1.2 amperes indefinitely without blowing. It should be noted that in the quantity 12.5 amperes above 0.5 ampere is allowed for the magnetizing current, so that the ratio of working current in the primary and secondary can be assumed as 1 to 10. Then there will be 120 amperes at 11 volts in the secondary. Assume that this feeds 10 letters in a sign, for individual flashing, each letter using 10-volt, 10-watt lamps and consuming a current of 12 amperes, a drop of 1 volt in the secondary wiring being permitted.

Assume further that the average length of run from transformer to letter, via flasher, is 50 feet, and each letter would be fed through 100 feet of wire, which for the drop assumed could have a resistance of 0.08 ohm; in other words, it could be a No. 9 wire. But this being an odd sign, No. 8 would probably be used, which wire would be large enough to take care of any possible reactance drop as well as of the resistance drop. The allowable carrying capacity of this wire is 35 amperes. Originally it was 25 amperes, which was one-half the current needed to raise the temperature of the wire from 75 degrees Fahrenheit to 150 degrees Fahrenheit and one-fourth the current needed to cause the average insulation to begin to fry and smoke. (See note to Rule 25 of Factory Mutual Company's Code, edition of 1895.) Then, 35 amperes is approximately 0.7 of the current needed to double the temperature, and 5 per cent of that needed to raise the insulation to the smoking point—that is, an increase to 50 amperes would raise the wire from 75 to 150 degrees (or higher on a warm summer night), and 105 amperes would make it fry and smoke.

The 12-ampere primary fuse is supposed to open the circuit at 15 amperes, and starting cold with the room at 75 degrees and current 50 per cent overload 18 amperes must blow for this size within one minute. These currents on the primary mean respectively 150 and 180 on the secondary.

Now suppose that trouble is located on one circuit of the secondary and is not serious enough to cause an overload; it may still do considerable harm to the individual wires; or suppose the circuits are arranged for continuous intermittent action so as to give a rippling or wavy effect; it may well be that a partial short-circuit will be unable to blow the primary fuses and yet cause enough cumulative heating effect on the bad circuit to seriously endanger it and its surroundings.

Thus obviously the secondary circuits should each be fused.

Answer 10 (E). Yes; if there are more than 1,320 watts on the secondary circuits.

Answer 11 (M). I can find no rule in the new edition of the Code precisely covering this point, unless by implication that part of Rule 23*d*, on page 40, does so.

Answer 12 (R). The secondary wires should be fused at each secondary circuit. Rule 23*b* states that a fuse must be placed where change of wire is made and the secondary wires of the transformer would be larger than the circuit wires.

Answer 13 (V). Circuits should not be arranged to carry more than 1,320 watts. The fact that the primary fuses are only 12 amperes does not guarantee safety, the ratio of primary and secondary amperage being the inverse of the voltage ratio.

Answer 14 (O). The secondary circuit should be treated as a separate system and fuses should be installed to protect the secondary wires. Assuming the ratio of secondary to primary current as 10 to 1 more, then 120 amperes would be required to blow a 12-ampere fuse in the primary, and it is not probable that the wires and fittings in the secondary circuit could safely carry this current.

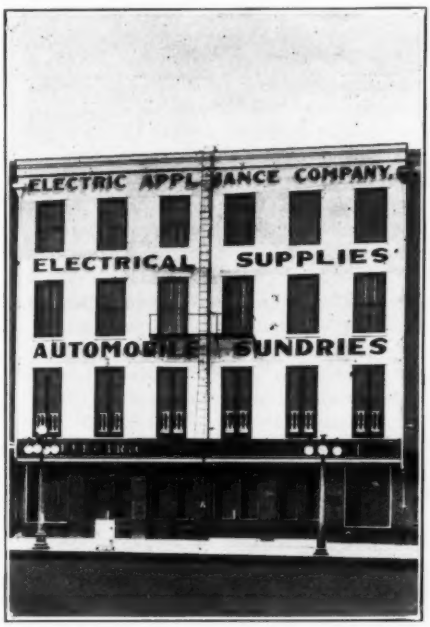
Among the Supply Men

New Quarters at New Orleans for the Electric Appliance Company.

The Electric Appliance Company has recently moved into new quarters at 408-416 Canal Street, New Orleans. The new location is on the principal boulevard of the city, opposite the Custom House, on the direct route to the Panama Canal, and anyone familiar with the topography of the city can readily recognize the advantages of this location.

The history of the Electrical Appliance Company of New Orleans, has been one of continuous progress and steady developmnt. In 1895, C. Robert Churchill was selling sugar-house machinery on a commission basis. Always a serious-minded fellow he went about his business in a most practical manner, cutting out a good deal of the frivolity and lightheadedness that characterized a good many of the others boys, and in a few years he had gathered about him a mighty strong coterie of friends and customers. In 1900 he forged out for himself, establishing an office building with outside warehouse facilities. By 1905 success had so far attached itself to his efforts that he was able to rent a store of considerable proportions at 139-141 Chartres Street.

Among the good friends and true that young Churchill had formed none was more fortunate for him or for the industry than his close acquaintanceship with W. W. Low and T. I. Stacey, of the Electric Appliance Company of Chicago. In 1906, these three men got together under the name of the Electric Appliance Company, of New Orleans, with Mr. Churchill as president. With the great reputation of the Electric Appliance Company of Chicago and the established good will of Mr. Churchill to work on, and sufficient capital to develop the business properly, the company began a remarkable development. In 1907 commodious quarters were secured at 205-209 Chartres Street. The business continued to grow and was soon recognized as one of the most responsible and extensive wholesale electrical supply houses in the south. A few years ago the growth of the business rendered the Chartres Street quarters inadequate and more warehouse space became necessary. The company now occupies a big store floor with warehouse space covering three stories of an entire building. The success of the company is due in a large measure to its well recognized policy of complete separation from any electrical contracting business. Mr. Churchill's personal policy is also one that is well recognized for the combined organization of the Electric Appliance Company in every part of the country that of maintaining the business on a basis that returns an adequate profit for the rendering of good service and the assurance to every customer of a square deal. Mr. Churchill, or "Colonel," as he is familiarly known, has not lost any friends by a strict adherence to business. He is one of the best of good fellows in a strictly honorable way, and in addition to his attention to business he gives a great deal of time to civic enterprises, and is one of the best informed men with regard to the resources of the South, its ways of doing business and its opportunity for a tremendous growth in the future. He was for years connected with the National Guard and Volunteer Service of the United States Army, passing through each grade and retiring with honorable mention as lieutenant-colonel. This service has given him a jury exemption for life and a record of work well done that few men at his time of life can boast of.



New Building of Electric Appliance Company of New Orleans.

The Varney Electrical Supply Company, Indianapolis, Ind., is working out a plan of co-operation in selling current-consuming devices with the local lighting company. This company is one of the most progressive electrical supply jobbers of the country and is always in the foreground with ideas looking to the development of the industry and effecting harmonious relations with the other elements of the business with whom it may come in contact.

E. H. Beazell, A. E. Kent, and D. P. Reighard have filed in the local court a bill in equity asking for the appointment of a receiver for the Commonwealth Electric and Supply Company, of 919 Liberty Avenue, Pittsburgh, Pa. The petitioners also ask for an injunction against a committee of creditors, composed of R. B. Hampson, J. P. Bell, J. J. Jackson and J. H. Short, which has taken over the business of the electric company. The plaintiffs are stockholders in the corporation which has a capital stock of $200,000, of which $83,050 is outstanding. They say the assets of the company are $82,697 and the liabilities $43,572. The plaintiffs allege that the business has been turned over to the committee unlawfully and that the committee will manage the business to secure their claims and the assets of the company will be sacrificed to the damage of the stockholders.

Federal Regulation of Hydroelectric Companies Proposed.

Regulation of hydroelectric rates by the Interstate Commerce Commission, whenever electric companies do an interstate business, was proposed in a bill introduced in the House of Representatives on November 29 by Representative William L. Igoe, of Missouri. The bill would amend the present interstate commerce acts, and was admittedly drawn to reach the Keokuk project of the Mississippi River Power Company, now furnishing electric power to the city of St. Louis.

The Igoe bill would require all companies to file schedules of their rates, and would give the Interstate Commerce Commission power to determine their reasonableness.

Public Service Commissions

MASSACHUSETTS.

The Massachusetts Public Service Commission has issued an order directing that each railroad and street railway company and other corporation subject to the Commission's supervision, which includes telephone and telegraph companies, shall submit a statement quarterly showing in detail (1) all payments made to newspapers and publicity men for advertising and write-ups; (2) salaries and expenses paid to and through its legal department to attorneys resident in the state or doing business for the company in Massachusetts; (3) payments for legal expenses to attorneys not regularly connected with the company, and their expenses; (4) payments for services rendered to the company in connection with legislation, whether by the Massachusetts Legislature or by any public officer or board of the State or any county or municipality; (5) sums paid for the purpose of assisting in the election or the defeat of any candidate for public office or any party or faction; (6) a sworn statement of all contracts or agreements for advertising, publicity or legal work in Massachusetts or for influencing or informing public or legislative opinion, and copies of such contracts as are in writing; (7) all payments which it has been the practice of some companies to charge to the account of "other expenses" or "general expenses." These statements shall show in detail the name and address of the person or firm to whom payments are made, the amounts, dates and nature of the services rendered. Companies having an annual gross income of less than $50,000 per year may be excused from the operation of this order, and any company whose income is above $50,000 may be excused from the operation of the order or have prescribed for it a substitute order at the Commission's discretion. The Commission's action is a result of the disclosures of the New York, New Haven & Hartford Railroad Company's activities in influencing public sentiment through liberal expenditures for write-ups, etc.

The Public Service Commission has approved the issue of $40,000 25-year, five-per-cent bonds, at par, by the Automatic Telephone Company, of New Bedford, Mass. The issue is to pay indebtedness incurred for construction and equipment of plant and for the purchase of property necessary to operation.

MISSOURI.

The application of the Jefferson City Light, Heat & Power Company for permission to buy the Jefferson City Bridge & Transit Company was granted by the Public Service Commission, and the deal will be closed at once. A formal order will be issued by the Commission permitting the purchasing company to issue $1,000,000 worth of bonds for improvements and extensions. This deal marks the formal entry of the McKinley trolley interests into Missouri.

NEW JERSEY.

The Board of Public Utility Commissioners has granted the application of the Bernards Electric Company for permission to issue bonds to the extent of $84,000.

WISCONSIN.

The Wisconsin Railroad Commission has issued its decision and order on the matter of the service rendered by the Milwaukee Electric Railway and Light Company on its Milwaukee street-railway lines. The order follows a very careful and comprehensive investigation of the traffic conditions covering a period of nearly two years. The standards of service prescribed in the order were formulated after a study of the traffic conditions as revealed by the traffic data gathered by the engineers of the Commission during the progress of the investigation. Tables are presented which show the actual and estimated number of passengers occupying the cars at all hours and on various days. "These tables," says the Commission, "show clearly that on a number of the company's lines excessive crowding has occurred day after day in the rush hours. Many cars with seats for 40 persons were observed carrying 100 or 110 passengers. Conditions of loading such as those disclosed in the evidence are certainly unreasonable and must be improved if the public is to be adequately served. It was therefore necessary for the Commission to determine the amount of improvement required to render the service reasonably adequate."

The order prescribes certain hours of the day, which are termed rush-hour periods, and fixes these periods for every day of the week. The order provides that during the non-rush periods a sufficient number of cars shall be operated so that there shall be supplied during any half-hourly period an average of at least 133 seats for each 100 passengers demanding transportation in a given direction at any point on the line. The schedules of the company heretofore have been drawn up on the basis of 100-per-cent load-factor, or, on the average of 100 seats per 100 passengers during any hourly period. The Commission held that since the loading must of necessity be variable a large number of persons will be obliged to stand day after day if the seating is provided for at the company's average. This fact was borne out by the traffic data gathered by both company and Commission. The basis of loading prescribed in the order should make it possible for every passenger desiring a seat to have one since due allowance has been made for those who stand by preference. The figure used is based upon thousands of observations on all of the Milwaukee lines and from which all abnormal conditions were eliminated.

With reference to the rush periods, the order provides that during the maximum half-hour of any rush period, there shall be supplied an average of at least 67 seats for every 100 passengers demanding transportation in a given direction. For other half-hours of the same period the same actual number of seats shall be supplied as in the maximum half-hour, except that not more than an average of 133 seats shall be required per 100 passengers.

Contrary to the requests of the city authorities, the Commission did not consider it advisable to specify definite schedules for each city line on the ground that a schedule ought to be flexible and under the control of the company. The order, however, prescribes the limits of headway to be maintained on the several lines during the various periods of the day.

A considerable portion of the decision was given over to the consideration of earnings, operating expenses and fixed charges. It was contended by the company that, under the rates provided by the Commission in the so-called three-cent-fare case, the earnings will not be sufficient to cover reasonable amounts for operating expenses including depreciation, and interest and profit on the fair value of the property devoted to the service under existing conditions, or without

any further improvement in the service. The Commission discussed the groups of expenses in detail and reduced some of the more extravagant ones to a normal basis. Income accounts in which the earnings, operating expenses and valuation of the company have been adjusted in accordance with the Commission's analysis show respectable surpluses available for improvements in the service, as shown by the following table:

	1912	1913
Revenues	$4,131,811.34	$4.181,016.84
Total expenses	2,827,012.80	2,983,213.24
Maintenance of way and structures	130,454.80	142,412.28
Maintenance of equipment	262,102.64	261,755.73
Power	390,333.87	364,688.99
Conducting transportation	1,064,844.26	1,094,745.93
Expense burden	106,190.62	184,973.10
Injuries and damages	185,931.52	198,473.80
Other reserves	35,000.00	35,000.00
Taxes	207,601.09	227,774.41
Depreciation	444,554.00	473,389.00
Surplus available for return on the investment	1,304,789.54	1,197,803.60
Fair value	11,600,000.00	12,000,000.00
Return on the investment at 7.5 per cent	870,000.00	900,000.00
Excess above return	434,798.54	297,803.60

The sale of 13 tickets for 50 cents, as ordered by the Commission in the Fare Case, is indefinitely postponed by an injunction and is now pending in the Supreme Court. From the reserves which the company is required to maintain to redeem the coupons issued pending the decision of the court, it appears that the total reductions in revenue due to the order in the Fare Case amount to about $21,000 in 1913 and $63,000 in 1912, which sums are materially less than the estimated reductions at the time of the former decision. When all reductions have been made in the surplus, including these above noted, there remains a total of $273,798 for 1912 and $191,803 for 1913 available for improvements. Upon the basis that a compliance with the present order will necessitate about 1,600 car-miles additional per day, the total cost would equal about $99,000 with 250 peak days, and $104,000 with 275 peak days. This sum, as the Commission points out, is but a portion of the excess available.

The Physics of Lighting.

The regular monthly meeting of the Pittsburgh Section of the Illuminating Engineering Section was addressed by Dean F. L. Bishop of the School of Engineering of the University of Pittsburgh, and was held in Thaw Hall, one of the University buildings, in order that the talk might be illustrated by some of the University physical apparatus. The meeting was preceded by a meeting of the board of managers, and dinner at the Schenley Hotel.

Dean Bishop prefaced his talk by the statement that he was dealing only with the questions of light—not illumination. The object of the lighting expert is not to produce white light, but to produce a light which will render objects easily visible and which will be agreeable to the normal eye. The normal eye is one which is equally sensitive to red, green and blue light. Almost all eyes, however, are more sensative to some one color than to the others. Also there is a great variation in sensitiveness to various intensities of light.

It is a well known law of physics that a heated body will radiate only those rays which it will absorb. Also the color of the light which is radiated, depends on the temperature. From this it is easy to reason that a black body at the correct temperature must give a perfect light. Hence all early improvements in lighting units were along the line of increased temperatures. The maximum amount of energy is radiated within the visible spectrum at 6,000 degrees Centigrade as white light.

Increases in temperatures are shown in the successive advances from the candle to the coal-oil lamp and the Welsbach gas mantle. The carbon-filament lamp was not an improvement over the Welsbach mantle, so far as radiating properties are concerned, since the temperature of the latter is higher and it has selective radiation. Selective radiation enables a greater proportion of the energy to be radiated in the visible spectrum than is possible with a black body, and hence increases the illuminating efficiency.

The light of the future must contain approximately equal proportions of red, green and blue light and must be capable of selective radiation. This is almost perfectly attained by the firefly.

The lighting effects which can be secured from radium were demonstrated by G. D. Kammer, of the Standard Chemical Company, who had a number of specimens for exhibition. The radiation from radium is given off so slowly that no great intensity is possible.

The next meeting will be a joint one with the Pittsburgh Section of the American Institute of Electrical Engineers, on Friday, December 12, in the auditorium, Oliver Building. Three central-station papers will be presented: "A Problem in Boulevard Lighting," by J. M. Froelich; "Variables in Street Lighting," by J. F. Martin; and "Some Aspects of Free Lamp Renewals," by Thomas F. Campbell.

Exports of copper for the week ended November 27 amounted to 4,299 tons, a decrease of 3,769 tons. Since January 1, 345,305 tons of the metal have been exported, an increase of 48,119 tons.

The Lighting of Colored Surfaces.

At a meeting of the New York Electrical Society held in the Engineering Society's Building on November 20, Bassett Jones lectured on "The Lighting of Colored and Ornamental Surfaces and its Relation to Artificial Illumination."

In discussing the subject Mr. Jones showed that in the design of lighting equipment for artificial illumination of decorated interiors, both the purpose for which it is intended to use the interior, and the character of the architectural treatment must be considered. The lighting must be so arranged that the decorative treatment may be properly appreciated. Usually it is impossible to solve both aspects of the problem at once. Each must be solved by itself and the result fitted together in the best way that judgment dictates.

The part of the problem dealing with architectural treatment is rarely, if ever, one that can be solved only in terms of light intensity or illumination efficiency. The shadows produced by the relief ornament on the surfaces lighted, and the color of these same surfaces introduce factors to which careful attention must be given, and these two factors must be properly balanced and the result made harmonious. To provide in the design of the equipment for these two factors requires a thorough knowledge of color and of the effect of shadow on relief ornament; for, after all, the architect is a worker in light. His materials are merely means by which he can produce arrangements in shade and high lights perhaps accented or otherwise modified by the addition of color, or in color only.

In order that the architect's ideal can be carried out satisfactorily, it is necessary for the engineer or the lighting expert to be able to understand and appreciate this ideal and to use light in such a way that the architect's construction can be properly seen. He must therefore know just how far and how much he can modify the color of painted surfaces without destroying the finer color balances. He must know the effect which the change in color of light has upon pigments and dyes, and also the effect that the material or character of surfaces to which the pigment or dye is applied, has on the color of the pigment or dye. He must also know just how far and in what way he can modify the shadows which serve to set forth relief ornament without destroying the effect of such ornament.

The problems outlined above are not engineering problems at all, but problems the solving of which really constitutes a new art.

The flexibility of modern lighting de-

vices makes it possible to produce exceedingly interesting, novel and beautiful effects, and helps to sever the bonds of precedent which have long bound the architect. The knowledge and training of the modern lighting expert makes it possible for the architect to employ designs in color and relief ornament which would be absolutely destroyed under the usual conditions imposed by artificial illumination.

One of the great difficulties in getting the architect to seriously consider these problems is the fact that in his color design he thinks in terms of pigments instead of in terms of light. He still adheres to the three-color theory in which red, yellow and blue are taken as the primary colors. If one asks him what pigments are to represent these primary colors he will be in somewhat of a quandary, but the average replies would indicate that English vermilion, gamboge and Prussian blue will represent what the artist terms primary colors. Now, as a matter of fact, in color of pigments we are really dealing with colored light. Thus, yellow pigment may be assumed to absorb all of the blue light that falls upon it, reflecting only yellow light as well as red and green, the mixture of which produces the sensation of yellow. There is not enough yellow light in normal white light to account alone for the luminosity or brilliancy of certain yellow pigments. Similarly blue pigment absorbs all of the red, yellow and green light falling upon it and reflects only blue light. When these two pigments are mixed together there results a broken green pigment, broken because in effect it is mixed with a large quantity of black, that is, its luminosity is greatly reduced. This is due to the fact that the yellow pigment in the mixture absorbs blue, while the blue pigment absorbs yellow, red and green, so that almost all of the light falling upon the mixture is absorbed, and a small quantity of green reflected. Hence every step in the mixture of pigments is a step toward black, and on the other hand, every step in the mixture of colored light is a step toward white. The theory of color in pigments can only be explained on the basis of the theory of color in light, which names as the three primary light colors red, green and blue.

Color in light can be produced in three ways: by absorption of certain selected wave-lengths; by the additive combination of certain wave-lengths; by the simultaneous reflection of separate selected wave-lengths. Usually any method of producing color combines all three methods. In absorption all of the wave-lengths, except those required to produce the proper color are absorbed by the medium. If a medium reflects light of a certain color when white light is thrown upon it, and transmits the light which it does not reflect, the color of the transmitted light must be the complementary color of the reflected light, since the two combined must produce white light. Hence if transparent pigments are used—and all pigments are more or less transparent—and such pigments are supplied to different colored background or character of materials, a certain portion of the light falling upon the pigment is reflected; the rest is transmitted through the pigment, and partially reflected from the surface upon which the pigment is applied, where its color is again modified by absorption, and still again partially modified by retransmission through the pigment to its surface, where it is mixed with the light reflected from the surface of the pigment. Consequently, the production of color by pigments or dyes applied to materials is by no means simple and depends not only upon the pigment used but also upon the thickness of the pigment layer, the medium with which it is mixed, the color of the surface, and the character of the surface on which it is applied. All of these aspects of the problem must be carefully studied if any accuracy in color balance is to be produced when the colored surface is provided with light artificial illuminants, the light emitted from which must of necessity differ from the color of daylight.

With the proper study in the selection of color screens, artificial illuminants, dyes and materials, some exceedingly interesting color combinations and color changes can be produced. This study, practically limitless, opens up a field for effects in interior decoration. By varying the color of the illumination in suitable ways, decorative designs in color may be made to change and assume new color balances with every change in color of light falling upon them. The use of dyes and pigments showing marked selective absorption and reflection lends itself to some very remarkable effects which have been employed largely in stage scenery.

These are only a few of the problems in the use of color, briefly outlined to indicate the enormous variety and scope of the future of the art.

The lecture was illustrated by a shadow and color booth, the Maxwell disks, and a small stage equipped with gauze scenery dyed with selective dyes.

Providing for straight three-cent fares and universal transfers after March 27, 1914, the city of Toledo, O., passed an ordinance under suspension of the rules which compels the Railways & Light Company to grant the lower fare.

PRESSURE RISES.[1]

By William Duddell.

This subject is one which is of interest because these rises, which occur under very varied conditions, are a source of trouble not only to the station engineer but also to the users of electricity, as they may endanger apparatus which is connected to the mains.

The principal causes of pressure rises may be broadly divided into three classes: (1) Resonance; (2) Switching; (3) Arcs and sparks.

Resonance.

An electric circuit which contains self-induction and capacity has, as is well known, a free period of its own, and electric oscillations may be produced in it provided that the resistance does not exceed a certain limit. If an alternator is connected to such a circuit, and if the period of the circuit is the same as the periodic time of the alternating electromotive force, then very violent oscillations may be set up in the circuit.

A limit to the strength of the oscillation is set by the apparent resistance of the circuit—by apparent resistance in this connection I mean a quantity which, when multiplied by the square of the current, gives the total losses in the circuit, including iron losses, eddy-current losses, etc., under the given conditions. For instance, if the apparent resistance R is comparatively small, then the voltage on the condenser or self-induction may rise to approximately $\omega L/R$ or $1/\omega CR$ times the electromotive force of the alternator, where L is the self-induction, C the capacity, and $\omega=2\pi f$, f being the frequency.

The most general case that occurs in practice is a long unloaded cable which is connected to an alternator. In this case self-induction in the circuit is mainly the self-induction of the alternator itself. The capacity is the capacity of the cable, for unless the cable is very long it may be considered to act in just the same way as a condenser connected to the terminals of the alternator. In this very ordinary case resonance may be expected to take place if the period $1/f$ of the alternator is the same as the free period of the circuit. It may be thought that this case would occur very frequently, but it does not do so under normal working conditions.

It is easy to show that in order to obtain resonance at any frequency the capacity current taken by the cable under normal voltage must be equal to the short-circuit current of the generator at normal excitation and at the frequency considered. No station could very well be run in this condition, as it means that

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1 Portion of presidential address before the Institution of Electrical Engineers, London, November 13.

the capacity current of the cables considerably exceeds the normal output of the generator. Although I have observed many cases of resonance of a third, fifth, seventh, and higher harmonics, I have seldom seen cases of resonance of the fundamental—one of them will be referred to later.

With regard to the question of the upper harmonics, if the wave form of the alternator is not a pure sine wave but is of such a shape that it may be considered to consist of a fundamental sine wave on which is superposed an alternating current having three, five, seven, etc., times the supply frequency, then the case is somewhat different, for, although the resonance of the fundamental cannot take place, a resonance of one of the upper harmonics is quite possible, since it is evident that as the frequency increases the capacity current taken by the cable increases and the short-circuit current for that frequency decreases, so that they rapidly approach one another. For instance, if the normal capacity of the cable were, say one-ninth of the short-circuit current of the alternator, then a resonance of the third harmonic takes place if such a third harmonic exists in the wave form. If the ratio were one-twenty-fifth, then the fifth harmonic might resonate. Now the ratio one-twenty-fifth is quite a possible condition, for this roughly corresponds to the capacity current in the cables being about one-tenth of the full-load current of the alternator, so that resonance of the fifth and higher harmonics may be expected in practice. Whether they are serious or not will largely depend upon the magnitude of the harmonics in the wave form of the alternator.

With modern alternators resonance seems to have practically disappeared in this country. In the early days I had some bad cases to investigate when resonance of one or other of the harmonics took place, which either caused failures or difficulties in regulating the voltage. With the modern machines the third, fifth, and seventh harmonics are generally so small that there is no trouble from their resonating. Resonance of the higher harmonics is more likely to take place, but owing to the very much greater losses due to eddy currents, hysteresis, etc., the resonance of these higher harmonics does not in general attain a serious magnitude, especially if there is any load on the machine.

There is one point which it is necessary to bear in mind in connection with the possibility of resonance of one of the higher harmonics. It is quite true that in the ordinary three-phase systems the wave forms between the phases are practically free from the third harmonic, but this is not necessarily true of the wave form between each of the terminals and the neutral point. Care must therefore be taken that the resonance of this harmonic does not occur. From this cause there might be quite a considerable potential difference between each of the cores of the cable and earth, whereas a record of the wave form taken between the cores might show nothing abnormal.

Switching.

In switching apparatus in and out of circuit there are a certain number of cases in which the pressure may rise considerably above the normal irrespective of any arcing or sparking which may take place at the contacts. The best known is probably the ordinary case of opening an inductive circuit such as the field coil of a generator. If the rate at which the current is suppressed is sufficiently great, very high voltages can be produced, because the whole of the energy that is stored in the self-induction is set free, and must be either dissipated or stored in some available condenser. If an uncharged condenser is suddenly switched on to a generator, then in the general case the potential difference between the terminals of the condenser will rise not only to that of the generator but will overshoot the mark, and may, in the extreme case if there are no losses, reach twice the value. This is analogous to the ordinary case of the ballistic galvanometer in which, when the damping is small, the initial deflection on switching it into circuit is twice the steady deflection.

We have here, therefore, two fundamental cases where pressure rises may easily occur in practice, namely, when inductive circuits are suddenly opened or when condensers such as cables are suddenly charged. The simple case of the inductive circuit is so well known that nothing more need be said about it except to point out that in the case of long feeders where the currents are large the energy stored in the self-induction of the feeders may be quite considerable; this is especially the case with direct-current feeders.

The effect of a switch not making perfect contact may lead to high pressures, because the upper limit to which the voltage on the condenser may swing is twice the difference of potential which is suddenly applied to it. For instance, if after the first contact the cable is left charged to a potential $+ v$ and then contact is made again at the middle of the following half-period when the voltage is $-v$, the change of voltage applied to the condenser is $V+v$, and the first swing may amount to $2(V+v)$, or the voltage rise measured from the zero line, $2(V+v)-v$, say, $2V + v$. In the worst case of $v=V$ we have a maximum of $3V$; or for a sine wave say 4.2 times the root-mean-square voltage.

I have already stated that no rise of potential takes place when switching off a condenser. If, however, sparking or vibration takes place at the contacts the effect just mentioned may occur.

As all cables and apparatus should at least be able to stand safely twice the working voltage for short periods, to switch on a cable should be quite safe provided no serious sparking takes place at the contacts.

The mathematical treatment of the general case of a long cable having distributed resistance, self-induction, capacity, and leakance, is somewhat difficult to follow in all its details. Dr. Kennelly's treatment of the subject by means of hyperbolic functions enables a great many of the properties of these cables to be readily understood, and when the complete set of tables of the hyperbolic functions of imaginary quantities which Dr. Kennelly is preparing are finished, the labor of calculating any special case will be considerably reduced. For the present purpose of considering pressure rises, most power-supply cables may be looked upon with sufficient accuracy as approximating to the two limiting cases of very short or very long cables. This leads to a great simplification of the discussion. For accurate prediction of the voltage drop and other properties of long lines, and also in telegraphy and telephony, these approximations are not permissible. A further simplification can be made if leakance be neglected, which is generally the case. Its effect if present will be to reduce rather than to increase the pressure rises.

Consider an infinitely long cable and let it be suddenly connected to an alternating-current generator at the moment when the potential difference is zero. As the potential difference increases at the generator end of the cable a current will flow into it charging up the condenser formed by the cable and earth, and this charge will travel along the cable with a certain velocity. Owing to the resistance and capacity of the cable the quantity of electricity flowing along it will become less and less as the charge travels along, so that one may look upon the wave traveling down the cable as being of continually decreasing amplitude. As the wave travels down the cable with a certain velocity the alternator continues to revolve, that is to say, the phase of the current wave applied to the end of the cable is continually changing, so that the phase difference between the alternator wave and the current wave traveling down the cable increases progressively. The net result is that in a very long cable the wave traveling along the cable continually diminishes in amplitude and lags behind the generator in phase.

If the cable is electrically very short there will be practically no diminution in amplitude or change of phase while the wave progresses along it. This is in

general the case for the underground cables and power lines in this country at ordinary frequencies, and under these conditions the cable may be considered to be replaceable by an equivalent arrangement of self-inductions and condensers, in which the capacity of each of the two condensers is equal to one-half of the capacity of the cable, and the self-induction and resistance of the coil between them are equal to the self-induction and resistance of the whole cable. The pressure rises that may occur in this cable are approximately those already referred to when dealing above with localized self-inductions and capacities.

Very long lines, such as those in use abroad, cannot be considered quite so simply. Suppose a long line is on open circuit at the far end, and, as before, it is suddenly connected to the generator at the zero point of the potential curve. Then the wave of current flows down the line, and when it gets to the open far end it is reflected or turned back on itself and flows back toward the generator; now at this reflection at the far end, the potential difference of the wave is doubled. The wave now travels back toward the generator, where if the generator is assumed to be very large the wave will go to earth quite freely and the reflection will take place with a reversal of phase and no increase in amplitude. The current wave will again travel back toward the far end of the cable where it will again be reflected, and it will travel successively backward and forward and so build up to the steady state. Consequently in the steady state of such a cable the voltage of the far end may be looked upon as being built upon a number of components of different phases. The magnitude of the voltage will naturally depend upon the phases and magnitudes of these components. First as regards their magnitude; as the charge travels along the cable the voltage decreases according to an exponential law

$$V = V_0\, \epsilon^{-aL},$$

in which a is the attenuation constant. For instance, in a certain cable the quantity ϵ^{-aL} might at a given frequency be 0.7. This would mean that the voltage at the far end was only 70 per cent of that suddenly applied by the generator, so that in transmission along the cable the first time there is a loss of 30 per cent. This wave is reflected as already mentioned and travels back toward the generator, where it arrives again reduced by 30 per cent, that is to say to 49 per cent of its initial value; the reflection then takes place at the generator and the wave travels back, arriving at the far end with about 35 per cent of its initial amplitude. This adds on vectorially to the initial wave so that the waves at the far end of the cable are a summation of a rapidly diminishing series of waves.

The phases and amplitudes of the components of the voltage at the end depends upon the frequency, the length of the line, and its constants. In order that the components may add up to a considerable total it is necessary that they should all arrive at the far end in the same phase, or more accurately that the phases should differ by a multiple of 2π. As the reflection at the generator end is accompanied by a reversal of phase the travel of the wave along to the end and back must be accompanied by a change of phase of π, *i.e.*, the alternator must have changed its phase by $\pi/2$ during the time the wave takes to travel along the line, which means that the length of the line is a quarter of the wave-length at this frequency. This condition leads to a building up of the potential at the end of the line.

Another way of looking at the effect is to consider that the wave which is started flows along the line and after reflection at the open end returns to the generator, where it should arrive at the moment that the alternator has reversed the direction of its electromotive force so that the returning wave and the electromotive force of the alternator act in the same direction and assist one another. This effect, namely the building up of the potential at the far end of the line on open circuit, is generally known as the Ferranti effect, owing to its having first been observed by Dr. Ferranti on the Deptford mains.

In general the velocity of propagation of the wave along the line is less than the velocity of light, say from one-quarter this velocity upwards for ordinary cables and lines, though nearly equal to it for straight wires in space away from other bodies.

At 50 frequency with a cable having a self-induction of 0.5 millihenry per mile and a capacity of 0.25 microfarad per mile the velocity of propagation is about 86,000 miles per second in round figures.

Hence the distance traveled in one-quarter period, or 0.005 of a second, is 430, so that the quarter of a wave-length will correspond approximately to 430 miles.

With higher frequencies the length to produce the effect is considerably shorter, so that the effect can become quite marked with the upper harmonics and moderate lengths of circuit, and considerable rises of pressure due to this cause have been observed in the United States.

It is well to point out that a load on the end of the line reduces the effect, so that on loaded lines it soon becomes inappreciable.

With the higher frequencies employed in wireless telegraphy the Ferranti effect is very marked. Aerials are always adjusted with their added self-induction to the quarter wave-length, so that the potential at the free or open end may amount to some hundred times the pressure employed at their base.

With the short cables in use in this country the effect is rarely observed, but it is of considerable importance from the point of view of the sparking and arcing that may take place in switching operations and during faults, which may generate oscillations of a suitable frequency to produce the effect to a very marked degree with comparatively short leads. The magnitude of the effect depends on the resistance being small, which is generally the case in practice.

Some very interesting cases occur when inductive windings are suddenly switched into circuit; for instance, the high-tension coils of transformers, induction motors, or any alternating-current apparatus. In this case there may be no observable pressure rise between the terminals of the coil, but yet during the initial stages the full pressure which is applied between the terminals of the coil may be so unequally divided between the windings as to produce locally differences of potential far above the normal.

In the case of a submarine cable, say an Atlantic cable, if the voltage is suddenly applied at this end, the wave starts off and travels toward the States, and the first trace of its arrival occurs rather less than 0.1 second later. In the case of the windings of an ordinary transformer the length of time required for the wave front to travel along the coil is probably less than 0.0001 of a second. In both cases during the initial stages practically the whole of the potential difference is localized.

The localization of the voltage on the turns of a transformer at the moment of switching it into circuit is of great practical importance and is the cause of many failures. The effect is further aggravated by any sparking which may take place at the switch contacts, which sets up high-frequency oscillations in the leads connected to the transformer. As the high voltage between turns due to switching in only lasts a very short time, too short to be recorded by an ordinary oscillograph, the failure of the insulation between turns may only take place after a number of switchings, when the insulation between turns having been locally weakened, heating sets in at the normal working voltage and a breakdown of the coil to earth soon follows. For this reason extra insulation is often placed on the end turns of transformers, or choke coils are used in series with them as a protection.

High-voltage motor windings are subject to a similar effect, and with a synchronous motor there is a further possible cause of localization of the pressure on a limited number of turns of the windings, not necessarily the end turns. This depends on the fact that

the self-induction and mutual-induction of the different sections of the windings are not necessarily equal, owing to the mechanical difficulties in making the short air-gap perfectly equal all round the machine.

The localization effect on the end turns of the apparatus is especially noticeable in connection with the high-frequency oscillations or with the steep-wave-front currents which may travel along overhead lines after lightning discharges. These are very similar in their properties, but, owing to the much higher voltage which may be induced, much more destructive and difficult to guard against than the steep wave fronts and oscillations that can be set up by switching on apparatus. This effect has been investigated by Jackson.

Switching off ordinary loads is generally safe, for even should the switch try to open the circuit when the current has its maximum value, it is improbable that the rate of decrease of the current will be sufficient to produce dangerous pressure rises. On the other hand, abnormal currents and short-circuits may give rise to excessive pressure, as the energy liberated at the break is so large that it may form an arc and blow the switch to pieces. If the rate of break is sufficiently rapid to avoid this, the rate of change of the current may be so great that a dangerous pressure rise is produced. A number of valuable records showing the switching off of large powers amounting to tens of thousands of kilowatts are given in a paper by Maguerre in which practically no rises of pressure are observable, but I think it is unwise to assume that this is always the case. The best means to employ to limit the short-circuit current of generators is one of the problems which faces designers at the moment, both to protect the machines themselves from damage and to reduce the risk of pressure rises on opening the circuit.

The whole question of the rate of change of current that may take place at the moment of switching off is really a question of the suddenness with which the arc or spark between the switch contacts can be extinguished, for except under very exceptional cases it is impossible to break any considerable current without some arc or spark forming at the contacts. The rise due to these causes will, however, be considered in the next section.

Arcs and Sparks.

Pressure rises may in many cases be traced to the properties which arcs and sparks have of facilitating or causing rapid rates of change of current. The properties of an electric arc are somewhat peculiar in that it is one of the few electric conductors which is in general essentially unstable. By this I mean that if the current be increased through an ordinary arc the potential difference between its terminals decreases, producing a further tendency for the current to increase, which if it is not limited by some other resistance in the circuit would tend to increase to an unlimited extent. On the contrary, if the current be decreased the potential difference between the terminals of the arc rapidly rises, tending to suppress the current altogether. In fact, it is quite well known that it is necessary to have a steadying resistance or its equivalent in series with any arc in order to reduce the tendency of the current to go off suddenly to infinity, or to become zero.

This instability of the arc favors the sudden suppression of the current should an arc be formed, and tends to produce pressure rises if there is any self-induction in the circuit, which in practice is always the case. The instability of the arc may be greatly increased if the electrodes are kept cool; for instance, if they consist of large masses of good heat-conducting material. Further, this effect is increased if the electrodes are close together so that they tend to cool the vapor column of the arc. A transverse magnetic field also makes the arc unstable. Shunting the arc with a condenser greatly increases this instability, because should the current through the arc decrease due to any accidental cause the potential difference between the terminals of the arc will increase. This will tend to cause the current to flow into the condenser shunting the arc, which current will be diverted from the arc. It should therefore tend to reduce still further the current through it, rendering the conditions more unstable than without the condenser as a shunt.

A great deal has been written about the difference between arcs and sparks. In my mind the fundamental difference between an arc and a spark is that in the arc the electrodes are being continuously volatilized, and the vapor of the electrodes takes part in the passage of the electric current. The spark, however, is generally of an intermittent or a transitory nature, the electrodes are not appreciably volatilized, and the current is largely transferred through the air. It is pretty obvious that there cannot exist any clear line of demarcation between the two phenomena, and that the one merges into the other under the above definition, depending on the mass of volatilized electrode present in the vapor column. The properties of the spark are more difficult to investigate than those of the arc owing to its transitory nature, but there seems little doubt that they are essentially similar with regard to instability. In fact, there are reasons to suppose that the electric spark possesses the same instability as the arc but in an enhanced degree.

Any arcing or sparking taking place in a circuit is liable to set up oscillations which may give rise to dangerous pressure rises. It is therefore necessary to consider the types of oscillations which may be produced by arcs or sparks. The best known case is the oscillatory discharge or charge of a condenser such as is used in wireless telegraphy.

If the source of supply is high-tension alternating, each time the condenser charges up to a sufficient voltage the gap will break and an oscillatory discharge will take place. This discharge repeats itself each half-wave, or several times per half-wave if the conditions are suitable. The activity of the oscillations depends very much on the condition of the spark. If a lot of conducting vapor is formed, or if the electrodes remain very heated so that the gap does not recover its insulating properties very quickly, then after the first discharge the condenser cannot be charged to so high a voltage, and the activity of the oscillations falls off. For this reason sparks taking place between large masses of metal which are good conductors of heat or in a magnetic field are more likely to be active than those that take place between carbon electrodes. If after the spark takes place the generator current follows, forming an arc and a quantity of vapor, the oscillations are generally reduced in activity.

If the supply is continuous current, oscillations can still be produced provided that the arc is such that $\delta V/\delta I$ is a negative quantity, where δV is the change in voltage produced by a small change δI in the current through the arc, and that the resistance of the oscillatory circuit is low enough. The quantity $\delta V/\delta I$ is not in general negative for large-current arcs in air, so oscillations due to this cause do not seem probable at first sight. Large-current arcs in gas and in magnetic fields can, however, produce powerful oscillations. Further investigation is required as to whether under the initial conditions of the formation of large-current arcs the instability may not be such that oscillations can be produced.

Intermittent discharge may take place either with alternating or direct current, and give rise to oscillations as follows. If the generator has a very drooping characteristic, the condenser will take an appreciable time to charge up to the discharge voltage. After the discharge, which may be oscillatory, has taken place, a certain time must elapse before the condenser is again charged to a sufficient voltage, so that a regular succession of charges and discharges will take place even with a direct-current supply. The time to charge the condenser depends for a fixed generator voltage on the length of gap, on the capacity of the condenser and on the impedance, including that of the generator. If the impedance is not too large the successive discharges

may follow one another very rapidly. It is possible with a direct-current supply at very high voltages, and spark gaps that are well cooled, to make the sparks follow one another tens of thousands of times per second. Probably these intermittent discharges play a considerable part in the production of pressure rises.

Sparks and arcs may in practice be formed at switch contacts or when faults take place. Under normal working conditions sparks mainly take place at the switch contacts, but when large currents are being broken regular arcing is observed at the contacts. In the case of a fault, except a sparking fault to earth with both poles insulated, the discharge at once takes the form of an arc. I have already mentioned that in switching on and off cables on open circuit, pressure rises may be produced should the switch contacts chatter in going in or out. A similar effect can easily be produced by sparks between switch contacts if they are held stationary and almost touching on sufficiently high-voltage alternating circuits. For in this case at the peak of each half-wave a spark will take place tending to charge the cable first in one direction and then in the opposite.

When switching off an inductive circuit a high pressure may occur should the current be interrupted suddenly. This well known effect in the case of direct-current circuits can also take place on alternating-current circuits when using oil-break switches, though it is usually supposed not to be the case. It is true that the oil-break switch in general does tend to open the circuit when the current is in the neighborhood of the zero value, but this is not always the case.

I have already mentioned that if an inductive circuit carrying direct current be interrupted by a switch, a condenser shunting the terminals of the switch will stop the arcing at the switch contacts and produce a serious pressure rise. The same occurs with alternating current.

Sparking at switch contacts may also set up oscillations along the leads in much the same way as the oscillations are set up in wireless aerials by sparking into them at their bases. The mere sparking into the lead will not in general set up very violent oscillations because these oscillations will have to pass round the generator, but should there be considerable capacity between the generator and the switch contact, oscillations may be set up which will pass through the condenser to earth. In this case the apparatus situated at the end of the lead might be subjected to considerable strain, and might run the risk of having its end turns damaged owing to the high-frequency oscillations set up along the lead.

At high voltages any sparking taking place between one point of an insulated circuit and earth will set up oscillations in the leads, connections, and apparatus. The whole circuit may be considered as equivalent to a complicated aerial system of wireless transmitter which is excited in the manner generally spoken of as plain aerial, that is, with a spark between it and earth. The effect of this is to set up a number of high-frequency oscillations in the system, producing high potentials at all points where reflections of the oscillations may take place, such as open ends and the connections to apparatus having appreciable self-induction. Berg has investigated a number of cases and has shown how a spark fault to earth may produce very high voltages localized on the end coils of transformers, etc.

Turning next to arcs, I have not yet come across a well authenticated case in practice of an arc acting as a musical arc and producing dangerous pressure rises. It is easy enough to produce them in the laboratory, but the conditions in practice do not seem suitable for maintaining continuous oscillations. I am of the opinion that there is a great deal more risk in intermittent arcs maintaining oscillations than from the arc producing continuous oscillations.

The opening of large currents, whether it be by switches or fuses or by faults which burn out is always attended by the risk that the current may be suppressed too suddenly and that the energy stored in the self-induction of the circuit may not be dissipated. In this connection I am inclined to think that sufficient attention has not been paid to the self-induction of the leads and cables. Although the self-induction per mile of the cables is comparatively small—it may apparently range from a fraction of a millihenry for cables very close together to some 5 millihenries for conductors like track rails on direct-current railways—yet the amount of energy that may be stored is considerable owing to the large currents that may flow at the moment of short-circuits or faults. It is to be noted that as the great part of the magnetic field is situated in air, should the current be suddenly suppressed the whole of the energy is liberated at once, giving rise to very high voltages. This is not necessarily the case in machines and apparatus, as with these quite a considerable part of the self-induction may be due to the lines of force threading the iron, and it is impossible for these to collapse so suddenly on to the conductors owing to the eddy currents they would produce in the mass of material; therefore when they do collapse some of the energy is wasted by this means and the pressure rise is reduced.

The exact values of the self-induction and capacity of the cables used for carrying direct currents do not seem to have received much attention. Approximately calculations can, however, be made. As an example, the self-induction of one mile of two 0.5-square-inch cables laid in non-metallic ducts at four-inch centers is about 1.6 millihenries, the capacity about 0.1 microfarard, and the resistance 0.176 ohm. Taking these figures the maximum possible voltage rise neglecting the self-induction of the machine is 252 times the current suppressed, if the cable is considered to be equivalent to localized condensers and self-induction. For 500 amperes interrupted, the limit of the pressure rise might thus be 126,000 volts.

If a short-circuit is suddenly interrupted somewhere in a long cable, a high-voltage wave front starts from it and travels in each direction towards the ends of the cable, where it may be reflected if the end is open or connected to a high self-induction, its amplitude being then doubled.

There is no doubt that in many cases of short-circuit—whether of a direct current or of an alternating current—the current is very suddenly suppressed. The arc is quenched somehow, to use a wireless term. It is easy enough to quench arcs with small current, but with medium currents, say a few 100 amperes, the arc appears to be more stable and a large amount of vapor is produced from the electrodes, yet the appearances seem to be that in the case of still larger currents the arc goes out with great suddenness. In ordinary cases of supply mains there may be two causes which tend to this quenching of large-current arcs. First and foremost, the considerable magnetic field produced by the current itself. Second, and this applies to insulated mains in inclosed spaces, the production of a gas surrounding the arc due to volatilization, and the splitting up of the insulating material. Third, the cooling effect of the large masses of the metal which are usually present in circuits intended to carry large currents. Whatever the true explanation may be, it seems to me that the properties of large current arcs, both direct and alternating, require further investigation, especially as regards quenching.

I have attempted to summarize as briefly as possible the causes of pressure rises. They are numerous. Very small changes in the conditions will sometimes make all the difference between considerable pressure rises and none of importance. Pressure rises are illusive to investigate; time after time one will repeat the test without hitting the exact condition, and then perhaps at last, after a number of trials without having made any apparent change, a considerable rise will be observed. No faith can be put in observations of pressure rises unless they are repeated many times. Tests repeated once or twice are not conclusive evidence if a rise is not observed. The importance of these rises to electrical engineers is well recognized.

ELECTRICITY ON THE POULTRY FARM.

By Albert H. Bridge.

In various parts of England specialists in poultry farming are engaged in interesting investigations of the effects of electricity in incubation work and in the illumination of hen runs. One authority claims that by using electric incubators he gets more and better birds, and others, who are disinclined to agree that the electric method of incubation is acceptable on the score of cost, affirm most positively that artificial illumination at certain times of the year increases the supply of eggs because it keeps the birds awake longer. The writer has tried to get to the bottom of these claims and has been favored with information from some of the authorities engaged in the experiments, which should be of interest.

Somewhat startling statements gained currency in the newspaper world both in London and in America a few months ago regarding some of the effects of electric incubation which appeared to call for investigation. It was said that on the biggest poultry farm in the South of England experiments had been conducted proving beyond the shadow of a doubt that young poultry responded with astonishing rapidity to the stimulus applied in a particular way. They were claimed to surpass the best on record in speed of growth, to keep their health in crowded conditions, and to be almost entirely independent of the differences in the seasons. Two groups, each of 400 chickens, were nurtured on the intensive system in trays placed one above the other. One of these groups was subjected to electric treatment with the result that they grew to marketable size (as fryers) in five weeks, and only six out of the 400 died. The second or non-electric group yielded only half their number as marketable birds, and that after twelve or thirteen weeks, nearly 200 of them dying, as the period of the year was unfavorable for healthy development.

One interesting and to some extent amusing statement respecting the electric chicks was that they were so charged with electricity that "a shock could be distinctly felt if the finger were put to the beak." To an electrical man this seemed hardly credible and in conversation with one of the leading poultry experts in England an opinion was sought on this point. His expression was more amusing than even skeptical as he volunteered the explanation that the sensation of electric shock if received was not from the beaks of the chicks but from the wire cage which had become "live." But the point was subsequently put to the owner of the poultry farm on which the experiments were conducted, Wm. Randolph Meech, of the West of England Poultry Appliance Works, Hamworthy Junction, Poole, Dorset, and in reply he said: "Until our experiments are complete I do not care to make any definite statement. The report in the *Daily Mail*, as far as I remember, was correct, including the electric shocks to be received from the beaks of the chicks. It is a fact that whenever one's hand came in contact with the beak of the bird quite a distinct and sharp shock was felt."

It is anticipated that as the result of larger experiments subsequently taken in hand it will be possible to announce that "the rearing of chickens under the high-frequency treatment" will prove of great value. The experiments are semi-private and they appear to relate to plants and animals as well.

The information obtainable regarding the effects of electric light upon young artificially incubated chicks is far more definite. This system has been used on several farms in the North of England and by others in the South for some time. A Quainton (Bucks) farm-owner claims that even with the use of paraffin lamps he has both increased "the growth of the artificially hatched chicks and raised the egg yield by 10 per cent." But users of the electric light claim results of a more remarkable value. Mr. William H. Cook, whose farm at Orpington, Kent, is world-famous, and who has about 200 hen houses, with facilities for 6,000 birds, tells me that he has increased his output in eggs during the dark months by between 30 and 40 per cent. The system of lighting employed was well thought out and is on the following lines: At six o'clock in the evening lamps of 32 candlepower are switched on with the idea of leading the occupants to the belief that the sun is still shining. Three and a half hours later the going down of the sun is imitated by the substitution of 16-candlepower illumination, and its setting is further effected by the extinction of these, and their replacement by eight-candlepower lamps, which, after fifteen minutes, die out, and all is darkness. The number of lamps of the three sizes at the Orpington hen houses is about 300.

During the recent Ideal Home Exhibition in London, Mr. Cook gave a demonstration of the advantage in egg-laying resulting from such an arrangement. The procedure was to send six hens into a darkened coop and six into an electrically illuminated one as above, at six o'clock each evening. The daily product of eggs was greatly in favor of the electrically deceived ones.

In my ignorance concerning such matters I asked Mr. Cook as to the effect upon the birds themselves of being kept awake longer than under normal circumstances, and whether this state of perpetual summer-time and overwork would not injure them constitutionally and reduce their value in the long run. The answer to this was that eggs are the result of feeding and a bird being awake longer feeds more, and if fed on the best stuffs, lays more eggs. Other poultry-farm authorities, however, seem to hold another view, for the owners of the Quainton farm mentioned above have written to the *Times* as follows: "A laying hen of the present time will produce on an average six eggs per week during her season, or 200 eggs per annum. If Mr. Cook can raise this by 40 per cent, the birds would lay 280 eggs in one year, or, allowing 100 days for their moult, on some days two eggs instead of one. This would be a most unnatural procedure, and would mean that the ovary would be strained to such an extent that, from a utility point of view, the bird would be useless during her second season." Mr. Cook, however, says that his birds are if anything better rather than worse for the altered experience.

In one of his recent writings, Mr. Cook says that when the breeder is cultivating a table trade "it is necessary to hatch nearly all the year round, and unless this is done it means that the birds will be old at some times and will be tough when eaten, compared with those hatched to come in when required." There is usually a good trade for spring chickens in England about February and March, and to meet this market with nice young stock hatching must be done in September, and "though the season is against growth, the youngsters will do well if properly treated." "With only short days the youngsters do not get many daylight meals, and for them to grow fast they must be fed with artificial light. Although they will be shy at first, the second or third time will find them quite ready for a meal, and as soon as the light is near them will run out ready for anything that comes to hand. Let this be done regularly and at the same hour, and the youngsters soon know when that time arrives, and will be ready and feed quite as well as in the daylight."

At Orpington a private electric plant furnishes electricity for lighting the various buildings, including the hen-houses, the incubator house, the large residence, etc.

Meeting of American Physical Society.

The regular Thanksgiving meeting of the American Physical Society was held at the University of Chicago on November 28 and 29 with R. A. Milligan, of the University of Chicago, and A. P. Carman, of the University of Illinois, occupying the chair at the different sessions. Of the 37 papers presented the following may be mentioned as of especial interest.

F. C. Brown and L. P. Sieg, of University of Iowa, were the authors of a paper in which it was shown that different selenium cells have different curves of sensibility to light of different wave-lengths. The maximum sensibility does not always occur for the same wave-length of light. It was also shown that throughout a considerable range the sensibility was constant for equal quantities of energy provided the exposure was limited to 0.4 seconds in duration.

R. F. Earhart, of Ohio State University, described some experiments with a glow discharge in a magnetic field whose direction was the same as the direction of the discharge. In air the discharge passes more readily, in weak fields than in zero field, but for strong fields (over 10,000 gausses) a higher voltage is necessary. This applies to air pressures less than one millimeter of mercury. At higher pressures it is found that all intensities of the magnetic field required a higher voltage for the same flow of current. Carbon dioxide showed the same behavior as air in this regard, but for hydrogen the effect at low pressures was reversed and all intensities of magnetic field required an increase of voltage.

Irving Langmuir, of the General Electric Company, presented three papers. In one of these it was shown that the thermionic current observed in vacuum tubes with a heated metal were very largely affected by the presence of gas, which cuts down the current from one value which would otherwise be obtained. Thus in the tungsten lamp the current is much lower than would be given by Richardson's formula. Most gases when present to the extent of 0.001 millimeter of mercury will reduce the current to one per cent of the theoretical value, although argon has no such effect. His experiments indicated that the thermionic current is not due to the disintegration of the metal. In the discussion it was brought out that the curve representing the relation between the thermionic current and the temperature has the same shape as that connecting the photoelectric effect with the intensity of the incident light.

The second paper by Dr. Langmuir dealt with the vapor pressure, boiling point and latent heat of evaporation of tungsten, molybdenum and platinum. The following values were found:

	Boiling Point	Latent Heat	Ratio
Tungsten ...	5,100	209,000	41.0
Molybdenum	3,960	162,000	40.9
Platinum....	3,810	127,000	33.4
Mercury	631	13,600	21.4

Temperatures are given on the Kelvin scale, that is, centigrade degrees measured from the absolute zero. The latent heat is given in gram-calories per gram-molecule. It will be observed that the ratio of latent heat to temperature of boiling decreases in the order of ease of vaporization. For liquid air this ratio becomes as low as 4.

The third paper dealt with the causes for disappearance of gas in vacuum tubes. It was shown that there were three causes: (1) chemical; (2) absorption; (3) electrical, due to the gas being driven into the walls. In the tungsten lamp the compound WN_2 is formed and it has been shown that nitrogen disappears at the same rate at which the tungsten evaporates. The same is true when there is oxygen present in the tube. The third effect varies with the temperature and with the potential.

Panoramic View of the Grounds and Partially Constructed Buildings of the Panama-Pacific Exposition. Left-Hand Section.

Saul Dushman, of the General Electric Company, reported determination of the ratio e/m of the electric charge to the mass of an electron, from measurements of the thermionic current. This gave a value 1.715×10^{7} in C. G. S. units. This value is slightly lower than those obtained by other methods, which may be explained by the uncertainties in the measured quantities.

The same ratio was measured by L. T. Jones, of the University of Illinois, making use of the ordinary method of deflecting cathode rays by electric and magnetic fields, but with arrangements which permitted of unusual accuracy. As a result of investigations along these lines he found a value of 1.748×10^{7}.

John Y. Lee, of the University of Chicago, reported measurements for determining the value of the elementary unit of electricity by the method of Professor Milligan, but making use of tiny particles of solid shellac in place of the oil drops used by the latter. The value obtained was 4.764×10^{-10} in C. G. S. electrostatic units. This differed from the value obtained with oil drops by about one-fourth per cent and the density of the particles of shellac which entered into the computation is uncertain by this amount.

Progress on Construction Work at the Panama-Pacific Exposition.

The accompanying illustrations give a panoramic view, in two parts, of the grounds and partially constructed buildings of the Panama-Pacific Exposition, in the outskirts of San Francisco, as well as a closer view of Machinery Hall, in which the electrical exhibits will be installed.

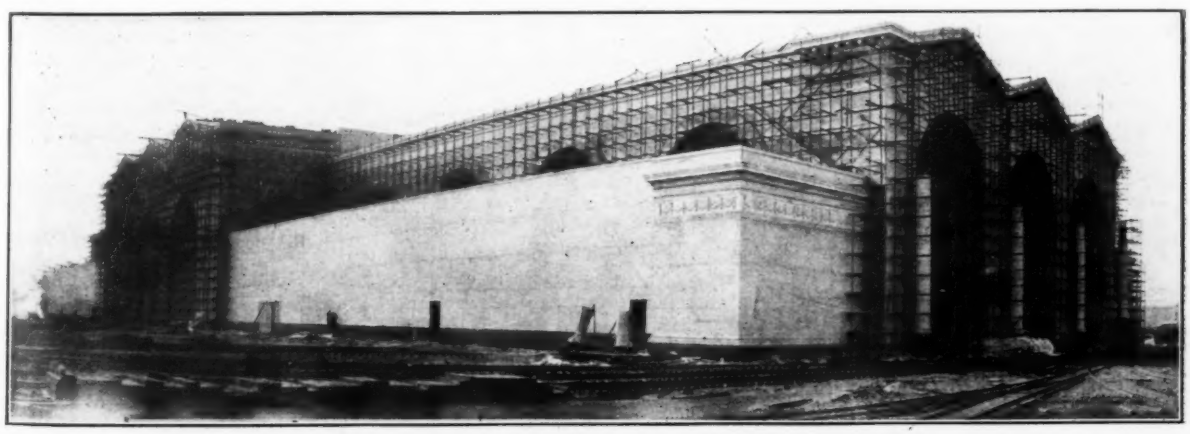
Panoramic View—Right-Hand Section of Grounds.

The panoramic view shows the physical characteristics of the site.

In the left background rise the Presidio Heights, a choice residence section of San Francisco; in the center background is the United States military reservation of the Presidio; while in the distance to the right is the famous Golden Gate, the entrance to San Francisco Bay from the Pacific Ocean. At the left, in the foreground, are the rapidly rising frames of the Palaces of Machinery (from the roof of which the photograph was taken), of Varied Industries, of Mines and Metallurgy, and of Manufactures. In the center are the frames of the Palaces of Liberal Arts and of Education, to the right of which are the frames of the Palaces of Food Products and of Agriculture. The floor of the Palace of Transportation is at the right, and just beyond it the exposition's yacht harbor, showing a lumber steamer lying at a wharf. At the extreme right are some of the green lawns of the esplanade of the Marina. The extraordinary rapidity with which the exposition structures are being erected is illustrated in the case of the Palace of Food Products, at the northwest corner of the main group of eight immediately adjacent exhibit palaces and alongside of the Palace of Education. The erection of the frames of the Palace of Food Products was commenced October 1, 1913. Within the next 30 days 900,000 feet of material was placed meaning that 80 per cent of the framework was placed by November 1. The total work completed at the latter date was about 45 per cent of the whole contract.

The exposition grounds face due north upon San Francisco harbor for almost three miles and average one-half mile in width.

The huge Palace of Machinery is shown as it appeared when ninety-three per cent completed. The building is 968 feet in length, 368 feet wide and has an extreme height of 135 feet. Its cubical capacity is 38,000,000 feet. Almost eight million feet of lumber were used in the structure. This photograph shows the tracks of the exposition's broad-gauge railway, of which twelve miles are now in operation throughout the grounds. The rails are laid into the exhibit palaces, permitting rapid installation of exhibits. The Palace of machinery is covered with a gypsum composition known as imitation Travertine stone. In color the imitation Travertine is a rich cream, several shades removed from white. It is as smooth as marble, almost as hard as cement, is waterproof and, according to reports, does not fade.



Machinery Hall where Electrical Exhibits will be Shown.

DO IT ELECTRICALLY.

An Appreciation by Elbert Hubbard of the Society for Electrical Development and Some of the Big Men Connected with It.

In the December issue of *The Fra,* that scintillating, iridescent product of the wit and wisdom of Elbert Hubbard, there appears a leading article entitled, "Do It Electrically." This noteworthy story was inspired by the meeting at Association Island, Henderson Harbor, N. Y., on September 3 to 6, when several hundred leading representatives of the electrical industry gathered together to discuss the subject of Co-operation in the development of the electrical industry.

As is well known, the meeting was held under the auspices of the Association Island Corporation, F. S. Terry, George F. Morrison and J. Robert Crouse acting as hosts and managers of the conference. Joseph B. McCall, president of the National Electric Light Association, was chairman of the meeting.

A number of notable addresses were made, and these have already been commented upon in these pages and in the pages of other electrical journals and the daily press. What impressed Mr. Hubbard greatly and led to his devoting a considerable portion of the current issue of *The Fra* to the reflection of this impression, was the character of the men attending the meeting, notably Charles P. Steinmetz, Samuel Insull and Henry L. Doherty. So that the record may be complete we will quote quite fully from Mr. Hubbard in *The Fra*:

Dr. Steinmetz.

"Steinmetz, next to Edison, is our great modern mechanical prophet. Steinmetz seems possessed of faculties beyond the average man. He has an intuitional sense that is almost uncanny.

"His 'boys' may work on an electrical problem for a year or more and fail to make it tangible. Steinmetz will then sit down and look at the machine for about five minutes, light a cigar, blow a cloud of smoke through it, and behold, the thing starts and chaos becomes cosmos!

"The subtlety and keenness of the man's power, with his ability to talk lucidly, logically, simply and sanely, mark him as one of the world-makers.

"When Dr. Eliot, then president of Harvard University, conferred the degree of Master of Arts upon Steinmetz, he did it with the words: "I confer this degree upon you as the foremost electrical engineer of the United States and, therefore, of the world.'

"If in some respects he has gone beyond Edison, the fact must not be forgotten that he has built on the master. Edison had not only to discover the principles of electricity, but he had to manufacture the machines to control the current.

"Well did Steinmetz say that in untamed Nature electricity is the most useless thing you can mention. Without the genius of man it is purely destructive in its nature.

"Steinmetz resents being called an inventor. He says: 'I am only an engineer. My business is to construct engines that will transport an elemental form of energy into a million factories and homes, dividing this energy up into infinitesimal parts so it can be practically used to run sewing-machines, to churn, to wash dishes and to do the dead lift and drudgery that otherwise would have to be done by human hands.'

"So let Steinmetz stand as a type of the modern engineer, who not only is an engineer, but is an artist, an economist, a teacher, a humanist."

Samuel Insull.

"The third world-maker was Samuel Insull, formerly private secretary to Edison; also hands and feet and eyes and ears for Edison. Ways and means are his playthings. He is what the French call an entrepreneur.

"He is a businessman, an economist, an employer, a teacher, and his principal business just now is to educate the world to an increased consumption of electric power.

"Insull's address was not insulated by opacity. The whole thing was illuminated, and without glare. It turned on the necessity of educating the world to the fact that electricity was the cheapest and most effective form of energy, 'the handmaiden of civilization.'

"One of the most impressive things that Insull said was: 'Within five years I have purchased at a fair profit to the builders 39 electric central stations or producing plants. I am now supplying all of the customers of these plants from one central station. The change has been made to the distinct gain of the consumer, in that the cost of power has been reduced on the average.'

"Mr. Insull also called attention to the fact that while the high cost of living prevailed in all commodities, yet electricity and electric equipment and appliances have steadily decreased in price. For instance, the electric lamps that are now being supplied to the public are so vastly increased in efficiency that the public can now secure practically three times the amount of light, for the same consumption of energy, as was possible three or four years ago. Not only this, but through the activities of the research laboratories of this country and Europe there is likely to be available, in the comparatively near future, lighting equipment in the way of incandescent lamps of even higher efficiency, which will confer tremendous benefits on the public."

Henry L. Doherty.

"Henry L. Doherty is President of the Society for Electrical Development. Doherty is an inventor, a mechanician, a financier, a builder and a teacher.

"Very seldom do you find a man who is successful in so many lines of human endeavor. The successful man is usually a specialist, and his achievement is bought with a price.

"Doherty is ballasted with brains. He is equipped with commonsense, and as Steinmetz put it, 'he is wired for service.'

"He never gets mentally short-circuited, because his humor is a saving fuse.

"Here is a man who has taken numerous bankrupt electric concerns, and turned on the quick current of prosperity. He is the most practical man on the electric job. He thinks constructively. His life is an affirmation. He is a graduate, and a post-graduate, of the University of Hard Knocks. He has grown by elimination, and knows everything that will not work. And so we find him today in his early forties, a success, untainted by selfishness, and unspoiled by flattery.

"Doherty thinks logically; his verb fetches up; he says things. As an orator the honey of Hymettus is on his lips. He possesses the graces of health, good nature, broad mentality, a firm grasp on the facts, and a high appreciation of the eternal fitness of things. With it all he has becoming modesty.

"He does not shilly-shally and yet he is never cocksure.

"Doherty is a leader of men—and naturally he is of Milesian ancestry.

"But his shillalah has transformed itself into a flute. Doherty is a citizen of the wide world, and he will leave the world a better place than he found it. He is a Themistocles, who can take a poverty-stricken hamlet and make of it a beautiful, happy, prosperous city."

Mr. Hubbard eulogizes Thomas A. Edison, who, it will be remembered, could not be present, but the letter he wrote to Mr. Morrison was reproduced by photographic process and Mr. Edison signed the 250 letters personally.

The Society for Electrical Development.

Mr. Hubbard is particularly enthusiastic over the Society for Electrical Development. He says:

"Just here it occurs to me that some one may ask what the object of this society is.

"Its intent is implied in its name. Its purpose is to increase the consumption

of the electric current, and therefore add to the well-being of the public and the business interests of all the members. The members are firms and companies, not merely individuals.

"The Jovian Society represents a membership of individuals who are interested in the business of producing the current, selling it, or manufacturing, selling or dealing in electrical appliances.

"The object of the Jovian Society is largely social. It gets men together who are in the same line of business. They go to school to each other—to use the phrase of Professor Edward J. Ward of the University of Wisconsin—and men who meet together sing together, laugh and eat together do not go away and defame one another.

"Animation, good-cheer, enthusiasm, are all very tangible assets in business.

"The Jovians now have a membership of over twelve thousand, and include practically all of the big boys in the business, from Edison, Steinmetz, Insull, down.

"The Society for Electrical Development aims to secure the entire co-operation of the great electrical business—co-operation being represented by the firms and corporations, as contrasted with the individual, co-operation for good fellowship and fraternity, as represented in the Jovian Order. 'Do It Electrically,' is the slogan of the Society.

"Less than 30 per cent of the population in America are served electrically. And yet in the face of advancing prices in every other line, electricity and electrical appliances have steadily, surely decreased.

"The gross sales of the electric current and electric appliances for the year 1912 were close upon a thousand million dollars, and this does not include the matter of telephone tolls, which of themselves figure a sum total of about two hundred fifty million dollars, or a little more than the total receipts of the Post-Office Department.

"The expense in selling the current and the appliances required in using it averages more than ten per cent, or, say, a hundred million dollars a year. Much of the expense incurred by electrical men in marketing their wares is on account of the effort to secure business which some rival already has; that is to say, central plants and manufacturers, dealers and contractors are bidding against one another. And in many instances there is a competition which is wasteful.

"If the money expended in trying to get business away from one another were used wisely to secure new business, it would be a great advantage to the electric world and to the public at large. And this is one betterment that Society proposes to bring about.

"No society was ever formed in any line of business on a more generous, liberal and unselfish basis. It is, 'All Together all of the time, for everything Electrical.'

"The question is not, Shall a producer of the current, or a manufacturer and dealer in electrical appliances, join this society, but, Can he afford not to?

"That is exactly what the Society for Electrical Development is doing, only it proposes, if possible, to do it better than the steel men have done, and in fact they should do it better, because they have the example of these strong men before them. They can avoid the mistakes of the past, utilizing the betterments.

"In short, the Society for Electrical Development is simply a great scheme for education, not only the education of the public at large, but education of every man who is in the business of producing the current or harnessing it and supplying it for the use of man.

"It is universally considered that the bringing together of men in the same line of human endeavor is a very great advantage and benefit. It educates, gives courage, widens the view, and expands business interests to the good of everybody. The best example of this is in the steel industry. The consumption of steel per capita in dollars is today double what it was 15 years ago.

"Instead of wildly fighting one another, the steel men have quietly, steadily, persistently, opened up new fields for the consumption of steel, and they are still at it, replacing wood with metal, not only to their great advantage but to the advantage of the public.

"The genius and the cunning of the world's great inventors have been devising ways, methods, plans, machines and appliances by which steel could be used economically.

"The expenses of this society form an infinitesimal tax on each member, but the benefits to be derived are very great, and in these benefits the whole business will participate.

"The work of educating the public to an increased consumption of steel was largely an enterprise of the United States Steel Corporation.

"The Society of Electrical Development, however, aims to admit every one who is in the electrical industry, and this now includes about 12,000 firms and companies. The society will not be controlled by any one branch of the industry or any one concern.

"I notice that members of the Jovian Order who came into the society early are very proud now of having a low 'potential.' Every member whose number is below one thousand is a pioneer or veteran, and is a little inclined to be chesty on account of his foresight and prophetic vision, just as Noah was when he was cruising in the Ark. It will be exactly the same with this Society for Electrical Development. Every man connected with it will be proud of the fact, and when you think that the 12,000 concerns that will make up this society represent a half-million electrical workers you perhaps can get some idea of the potential power of the organization."

The Presidential Message.

In his annual message to the Congress, following the opening of the regular session of that body, President Woodrow Wilson, on December 2, said, among other things:

"I think it will be easily agreed that we should let the Sherman anti-trust law stand, unaltered, as it is, with its debatable ground about it, but that we should as much as possible reduce the area of that debatable ground by further and more explicit legislation, and should also supplement that great act by legislation which will not only clarify it but also facilitate its administration and make it fairer to all concerned."

After promising another message on the subject, he said: "It is of capital importance that the business men of this country should be relieved of all uncertainties of law with regard to their enterprises and investments and a clear path indicated which they can travel without anxiety."

Regarding natural resources he said: "We must use the resources of the country, not lock them up. There need be no conflict or jealousy as between state and federal authorities, for there can be no essential difference of purpose between them. The resources in question must be used, but not destroyed or wasted; used, but not monopolized upon any narrow idea of individual rights as against the abiding interests of communities. That a policy can be worked out by conference and concession which will release these resources and yet not jeopard or dissipate them, I for one have no doubt. A common purpose ought to make agreement easy."

Telephone Train Dispatching Replaces Telegraph.

The Cincinnati, New Orleans & Texas Pacific Railway announces that a telephone line will be immediately constructed between Oakdale, Tenn., and Chattanooga, 84 miles, upon the completion of which the telephone will be used for dispatching trains on the entire line between Cincinnati and Chattanooga. Intervening lines have already been constructed.

New Electrical and Mechanical Appliances

Best Electric Company's Lock Sockets.

The increasing number of tungsten lamps and reflectors now being used has brought about the development of various methods of locking lamps in place so as to prevent their unauthorized removal or theft. Some of these devices have proved quite satisfactory and others have been circumvented by the ingenuity of those maliciously inclined. Realizing the need of an absolutely reliable locking device, the Best Electric Company, Pittsburgh, Pa., has placed on the market a new lock socket in which are incorporated many ingenious features.

One distinctive feature of this socket is that there is nothing in its appearance to indicate that it is equipped with a lamp lock and therefore invites tampering. The socket looks practically like any other socket, but is not as harmless as its appearance would indicate. The socket is installed in the same manner as any other and when the lamp is screwed into place it cannot be removed without breaking the bulb. This makes the device an extremely valuable one for hotels, shops and other public or semi-public places where the owners of the establishments have provided expensive lamps and reflectors and do not wish them to be interfered with. Likewise in places where jarring or excessive vibration is liable to loosen a lamp from an ordinary socket, the new socket is a valuable means of preventing this.

Fig. 1.—Best Lock Socket with Brass Shell and Cap.

Fig. 1 shows the new Best lock socket with brass shell and cap. In the flange on the cap is observed a rectangular button, depression of which with a slight turn, permits ready separation of the cap and shell; this feature is known as the "Easy Fastener" shell and cap. These shells and caps are interchangeable with any others of the same line. The cap and shell are securely fastened together at four points. In the interior of the socket there is provided between the porcelain terminal section and the brass screw shell for the lamp an intermediate section made of insulating compound and containing a unique ratchet device with a spring plunger and double cam. This is secured to the screw shell and so arranged that the lamp can readily be screwed into the threaded shell, but when it has once been inserted it is impossible to unscrew it unless the outer shell of the socket has been removed so that the fingers can hold the intermediate section containing the ratchet device just referred to. Therefore, when the socket and lamp are installed and an attempt is made to unscrew the lamp the screw socket shell merely rotates within the outer shell but the lamp does not become loosened.

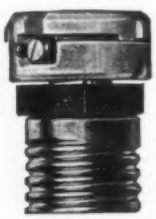


Fig. 2.—Interior of Socket.

In order to replace a worn out lamp the tip of the lamp is first broken off, thus spoiling the vacuum and preventing the glass from being blown about when the bulb is broken; the glass is then broken off close to the base of the lamp; the outer shell of the socket can then be removed, and finally, by holding the rotating part of the lock the old broken lamp base is unscrewed; the outer shell is then replaced and the new lamp put in. This entire change can be made in something like 30 seconds or less. No key is required for making the change, from an old to a new lamp and no key can unlock the lamp.

The company also makes a porcelain shell and cap for use in damp places. A black composition shell and cap, shown in Fig. 3, is made practically like the porcelain shell just referred to. In each of these the cap and shell are fastened by screwing the two parts together, a large, coarse thread being provided at the joint, so that no screwdriver or manipulation of small screws is needed. This composition socket is made of very rugged construction so as to withstand considerable abuse and also be weatherproof and of high insulation. This composition is not a rubber compound and will not burn or break easily. Both the porcelain and composition shell and cap can be used with the Best lock socket.

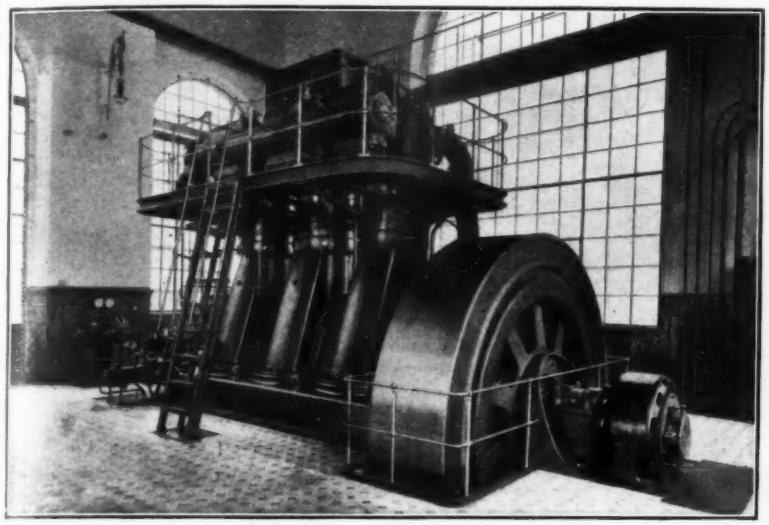
Fig. 3.—Socket with Composition Shell and Cap.

New Design of Alternator with External Rotating Field.

While the Diesel oil engine is becoming largely used for driving dynamos of various kinds for station work and while the usual form of generator can be run with it, there is room for improvement in this class of work by adopting a special design for alternators, etc., so as to adapt them more closely to the conditions which prevail in the Diesel engine. Recognizing this fact, the Oerlikon Maschinenfabrik, Oerlikon, Switzerland, has been engaged in producing a type of generator which is specially adapted for running with the oil engine, and in some cases it can even be used to advantage with steam engines. The new alternator departs quite a little from customary practice in the use of an inner fixed armature and an outer rotating field, such as the illustration shows. The object in this makeup is to have a heavier flywheel for the same general size of alternator than the ordinary design will afford, for on account of the fact that the gas or oil engine does not run at as uniform rate as the steam engine, a greater flywheel effect is needed for the same

number of cranks in order to secure uniformity of angular speed throughout the revolution, this being especially desired when it comes to working alternators in parallel.

The generating group shown has a 430-kilowatt alternator of 220-volt type, working at 150 revolutions per minute. It is



Diesel Oil Engine and Oerlikon Alternator with External Rotating Field.

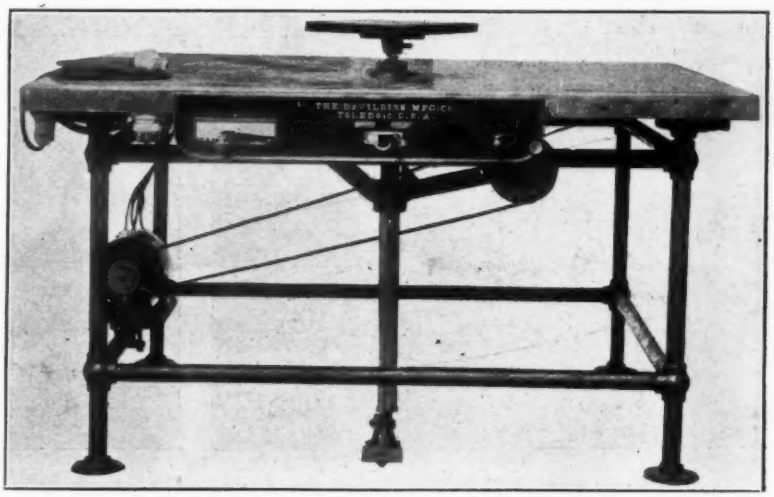
erected at the electric plant of Ha Goule Lt. Imier, Switzerland, and is one of quite a number now in operation in various parts of Europe. The construction of this alternator is simple and efficient. On the engine shaft next to the engine is mounted the field which consists of a spider and a heavy rim carrying the field poles so as to overhang and surround the fixed armature. This latter is made up of a spider and laminated ring, the spider being mounted on a machined flange ring against a cast-iron support which is seen at the end. This support forms the vertical end mounting for the armature ring as well as the bed plate for the bearing and exciter. While the armature is normally bolted against the side support, it can be also unbolted and rotated about the flange ring so as to bring all parts of the armature winding to the top for inspection. Built in two halves, the flywheel piece or field can also be grooved and used as a pulley for rope drive.

It will be seen that by the use of the outer rotating field, a greater flywheel effect for a given size of machine can be secured, so that it is not necessary to make a machine of too large diameter nor to use a separate flywheel which would of course be a disadvantage in many ways. The new alternators are made in many sizes, from 50 up to 1,400 kilowatts and even larger, and the operating company, the Oerlikon firm of Oswaldestre House, London, states that there are about 35 such groups in use in various European countries.

A Motor-Driven Machine for Use in Painting Small Objects.

For covering comparatively small objects and parts with paint, japan, enamel, lacquer, etc., the machine shown in the illustration is very effective.

The article to be painted is placed on the elevated platform which is rotated by means of a small Westinghouse motor mounted under the table. The paint, or other material, is sprayed on by means of compressed air, thus covering the article more rapidly than can be done by brush work, reaching all parts of carvings, irregularities, etc., and showing no brush marks.



Motor-Driven Painting and Enameling Machine.

Control levers are provided in the apron of the machine. An operating pedal is also placed at the base of a tubular stem. The circuit switch is conveniently arranged beneath the edge of the table. The current taken by the motor is small, so that the machine can readily be connected to an ordinary lighting circuit. When it is necessary to remove the fumes, the revolving stand is mounted inside a hood which is provided with a motor-driven ventilating fan.

The machine is manufactured by the De Vilbiss Manufacturing Company, Toledo, O.

Shipping Cedar from Logging Operations to Distributing Yard.

A great many users of cedar poles are not well acquainted with interesting features connected with the various operations before the poles are delivered to them ready for use. An important element in the handling of cedar products is their economical transportation from the point where the logging operations have been carried on to the yards where the timber is sorted and prepared for distribution. An interesting series of photographs illustrating this stage of the process has been placed at our disposal by the Crawford Cedar Company, Menominee, Mich.

This company owns a number of extensive timber tracts adjoining the northern shores of the Great Lakes. One of these is near the Cedar River, Mich. In the wintertime a steam logger is employed for hauling large quantities of poles and other cedar products from the woods or the scene of cutting operations to near the mouth of the Cedar River. Here they are put in piles or skidways adjoining the banks of the river. A great many thousand pieces of timber are also banked on the ice at different points along this river with the expectation that

the thaw and spring freshets will drive them down to be held at the gap ready for being rafted in boom lots to the company's large distributing yard at Menominee, Mich. The distance between these points is about 40 miles and the waters of Green Bay are used for this purpose.

In Fig. 1 is shown a large lake tug and an associated tender tug arranging the boom in the lake just outside the mouth of the Cedar River. This boom consists of a long double string of logs joined together end to end. The large tug has brought this boom from Menominee and its sister tug, as well as a smaller gasoline tug, are shown in the illustration spreading out the two halves of the boom and preparing to fasten the ends to the piers and docks at the mouth of the river. The idea is to make this boom or connected string of logs act as a large trap into which will be driven the loose timbers from the river. After this boom is filled with all the timber that is to be moved, the ends will be joined together around it and the entire body hauled down the lake to its place of destination. A closer view of a part of the boom is shown in Fig. 2. This shows the connected logs forming the boom itself and also a number of loose pieces of cedar that have already floated out into the lake and are confined by the boom.

At the mouth of the river a closing boom has been drawn so as to keep the timber which has been accumulating from floating into the lake until the lake boom is ready to receive it. As soon as the latter has been prepared, men are put to work to loosening the cedar or "watering" it so that it will float out into the lake boom; this is shown in Fig. 3. In Fig. 4 is shown the gasoline tug plowing through the aggregation of logs so as to open up the river gap while a head of water is on. This illustration also gives a partial idea of the amount of timber already afloat in the river, but a better conception of this is shown in Fig. 5, which illustrates a longer stretch of the river just

Fig. 1.—Placing Lake Boom for Shipping Cedar at Mouth of River.

Fig. 2.—Near View of the Lake Boom Ready to Receive Cedar.

Fig. 3.—Watering Cedar in River so as to Float into Lake Boom.

Fig. 4.—Gas Tug Opening River Gap to Permit Cedar to Float Out.

Fig. 5.—Long Stretch of River near Mouth Full of Cedar.

Fig. 6.—Lake Raft Being Sacked into Pocket Booms after Arrival.

before the opening of the gag boom to float the cedar out. The river is actually full of timber for about a mile from the gap at the mouth, the view in Fig. 5 showing only a small portion of this distance.

As soon as the timber has been moved from the river into the lake boom the ends of the latter are removed from the dock and securely tied together. The lake boom is then ready to be moved to Menominee. This boom when closed and in motion constitutes really an immense raft having an area of about 20 acres; the volume of the timber contained therein on the basis of log measure averages between four and five million feet of timber. Although this method of rafting timber is somewhat going out of use, the Crawford Cedar Company has employed it very successfully. Recently there was rafted or towed from the Canadian shores of Lake Huron an enormous volume of cedar consisting of nearly 15,000 poles, 30,000 ties and over 100,000 fence posts. The raft moved across Lake Michigan to Menominee in Green Bay without any difficulty whatever and without any loss of material. This was the first time that so much cedar had ever been handled in this manner or towed such a distance. Pulpwood is frequently handled in this way and the company felt that it would be safe to use the method also for cedar, if proper precautions were taken. The success of this method of getting its cedar from the woods to Menominee has been complete for several years and from seven to ten rafts of the size referred to above are shipped each season.

On arrival at Menominee two tugs take another set of booms out into the lake and empty the material from the large lake boom into these smaller ones and then draw it into the sorting gap pockets at the dock. From this point all of the timber is taken from the water and sorted into piles by traveling cranes. The large quantity of material to be handled necessitates using machinery at every possible stage of the operation. Fig. 6 shows a view of the lake boom shortly after its arrival at Menominee. Two tugs are sacking the raft from the lake boom into the pocket booms.

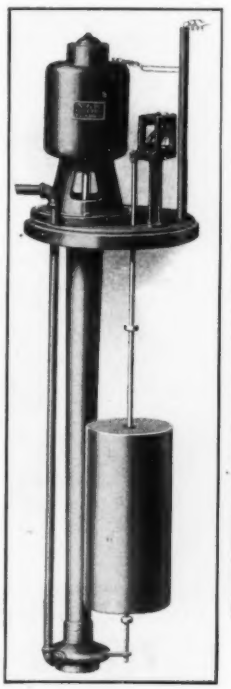
The Menominee yard of the company is very favorably situated on the waters of Green Bay. Five large docks have been constructed for the handling of posts; there is also a very large piling ground for poles, ties and other cedar products. Excellent facilities are at hand for shipping the material not only by water, but also by way of four railroads which run their tracks into the yard. Two steam derricks are used for handling the material in the yard.

Automatic Electric Cellar Drainer.

Those who are troubled with wet cellars or basements will appreciate the value of the automatic electric cellar drainer illustrated herewith. This device, it is claimed, is the first practical drainer of moderate price suitable for private residences, apartments, elevator pits, subways, etc.

As shown by the diagram it consists of a centrifugal pump direct connected to a vertical Westinghouse motor. The pump is installed in a three-foot well into which the seepage drains, the motor and control apparatus being at the floor level where it is accessible for inspection and is out of the way of dampness.

A float plays between two stops on a vertical rod that is connected with the motor-control switch. When the water in the well rises sufficiently to cause the float to press against the upper stop, the motor is started and continues in operation until the water level is lowered so that the float presses against the lower stop, when the current is cut off. The seepage is thus cut off without attention, an occasional inspection and lubrication being all that is required.



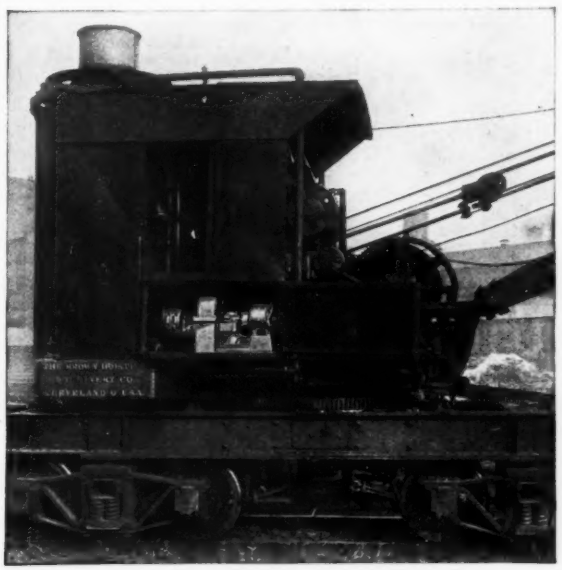
Electric Drain Pump.

This pump has a capacity of 500 gallons per hour against a head of 5 feet, and 150 gallons per hour against a head of 20 feet. To install it all that is necessary is to provide a well three feet deep, place the pump, and make the electrical connections. It operates from the electric lighting circuit. The Vaile-Kimes Company, Dayton, O., manufactures the outfit.

Locomotive Crane with Turbogenerator for Lifting Magnet.

In order to get away from the necessity for dragging power wires along the track on which locomotive cranes using electromagnets work back and forth, experiments have been made in the way of fitting these cranes with small engine-driven generator sets to furnish current for the magnet. Much trouble has been experienced with these reciprocating sets and the present development points to the rapidly extended use of small turbogenerator sets for this work.

One of the most recent applications, in Cleveland, O., is illustrated herewith. The crane, of 15-tons capacity with a 40-foot boom, has been fitted by the Brown Hoisting Machinery Company, of Cleveland, with a Terry five-kilowatt turbogenerator set, built by The Terry Steam Turbine Company, Hartford, Conn. The magnet, energized by current from this unit, is used for handling pig iron and scrap at any point within the reach of the boom.



Turbogenerator Set for Lifting Magnet.

The crane is moved by a reciprocating engine in the usual way, and the swinging and elevation of the boom are taken care of in a similar manner. The small generator set, entirely independent of the other operating portions of the mechanism, is mounted as shown in a compartment beneath the floor of the operator's cab, where it is entirely out of the way. Fitted with sight-feed lubricators, the bearings are kept flooded with oil and reports indicate that the little set is giving complete satisfaction.

Among the special features of this unit are the indestructible rotating wheel, a wheel so rugged that the passage of the large quantities of water due to starting up from cold, does not affect it. Full power can be obtained in less than a min-

ute, and aside from occasional oiling, the turbine receives no attention. The accurate balancing of the rotating parts practically eliminates vibration, thus permitting the use of a small, light and inexpensive base which is bolted rigidly to the crane. The whole set is in a pocket or shelf completely out of the way, and in operation is hidden from sight by the door of the compartment.

Efficient Direct Lighting in Ford Service Stations.

Of all the 300 or more companies manufacturing automobiles in this country, the Ford Motor Company, Detroit, Mich., enjoys the distinction of manufacturing and selling more cars than any other. The popularity of its cars has been brought about by their excellent construction combined with exceptionally low price. In order to produce a car of its serviceability at a moderate price the company has been compelled to make use of the most up-to-date efficiency methods and to manufacture on a very large scale. Efficiency is carried out in every detail of the entire organization.

An example of this is shown in the construction of unique service stations which the company is now establishing in the principal cities of the country. These service stations, which are something of a new departure in the automobile industry, are unique in being not only district sales offices but they also are used as assemblying points, since the parts of the car equipment are shipped from the Detroit factory to these branches in bulk at a great reduction in freight charges. In each of these service stations is also provided a completely equipped repair plant. These service stations have been, or are now being, installed in San Francisco, Seattle, Denver, Chicago and Memphis.

Fig. 1.—Efficient Lighting in Ford Service Station, San Francisco.

In the San Francisco service station, to which particular reference is made in this article, the efficiency ideas already referred to are carried out in every detail. The structure is a reinforced-concrete building. The lighting system installed therein is of the direct type. Tests made of it have shown such exceptionally good results that it has been adopted as the standard for all of the service stations.

Fig. 1 shows a view of one of the upper floors of the San Francisco station when the latter had practically been completed. The bays in these floors are 25 by 28 feet and on the upper floors the ceiling height is 12 feet 2.5 inches clear. Each of the bays was equipped with four outlets and each outlet was provided with a 100-watt clear tungsten lamp and silvered-glass mirror reflector. The arrangement of lighting units is shown in Fig. 2, which also shows the location of test stations during a test of the equipment made by Romaine W. Myers, consulting engineer, Oakland, Cal. The lower edge of the reflectors is 11 feet 5.5 inches from the floor. The reflectors completely screen the lamp. A view of one of these Beehive reflectors is shown in Fig. 3. The reflector is made of a single piece of glass specially corrugated and coated with silver on the outside, which is then protected by a green elastic enamel backing. The inside of the reflector is given a fire glaze which makes its cleaning extremely easy, as it is necessary merely to wipe out the reflector with a dry cloth, washing being unnecessary. The enamel backing used thoroughly protects the silver from tarnishing or deterioration.

Fig. 3.—The Reflector Used.

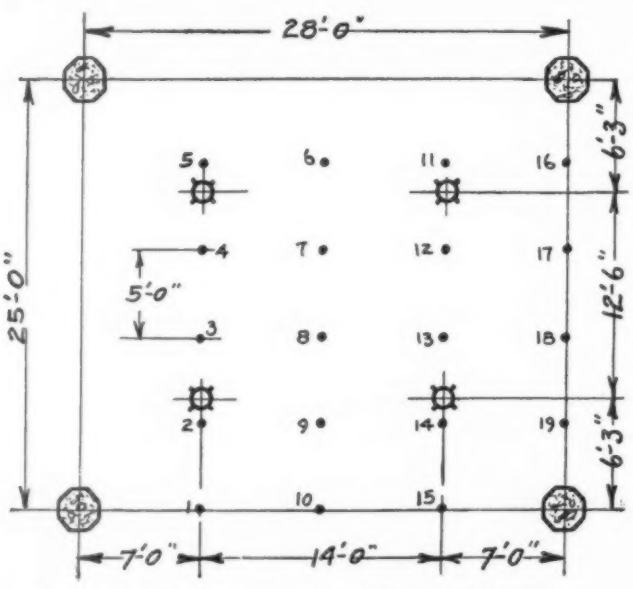


Fig. 2.—Layout of Typical Bay and Location of Test Stations.

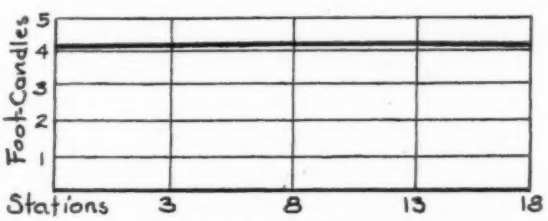


Fig. 4.—Uniformity of Resulting Illumination.

In a test made on the third floor of the building, readings were taken on the test plane 35.5 inches above the floor surface. With the test stations located as shown in Fig. 2 there was obtained a value

of 4.13 foot-candles as the average of the readings at the nineteen stations; the lowest reading was 3.96 and the highest reading 4.25. Fig. 4 shows graphically the extreme uniformity of the illumination produced. As stated above, four clear 100-watt lamps are used per bay, the area of these bays being 700 feet. This amounts to only 0.57 watt per square foot. The ceilings are white and the floor is of concrete. On the first or garage floor, which has a higher ceiling, only one large lamp is used in the center of each bay.

New Double-Deck Car For Washington.

An innovation in street cars in Washington, D. C., which may go far in helping to solve transportation problems there will be instituted on the lines of the Washington Railway and Electric Company. A double-decked car, capable of seating 98 passengers, or practically double the number which the ordinary car accommodates, is now in Washington, and the finishing touches are being put on under the direction of Master Mechanic Wenner. It is shown in the accompanying illustration.

Double-Deck Street Car for Washington, D. C.

The new car, which will be finished in mahogany on the lower floor and cherry on the upper, has a number of special details of construction carefully calculated with a view to the service it is expected to perform. The ceiling of the lower floor will be lower than that of the ordinary car, to permit extra space above, and for the same reason it will be run on smaller wheels, only 24 inches in diameter. Thirty-three and 36 inch wheels are in ordinary use.

Admission to the upper floor is obtained through a stairway at the rear, while the exit staircase is at the front. Both upper and lower compartments are of the semi-convertable type, and by an ingenious invention may be quickly changed for use as open or closed, according to the weather. The seats on the lower floor are arranged as in the ordinary center-door car, while above they are placed longitudinally.

The new car is to a certain degree in the nature of an experiment, but has been so carefully planned that the company feels sure it will be successful. This means that it may be followed by a number of others, with the aim of relieving the strain put on the system during the morning and evening rush hours.

Copper-Bearing Sheets and Tin Plates.

The question of increased durability from sheet-metal products is an important one, and it is quite natural therefore that the advent of copper-bearing sheets and copper-bearing terne plates, together with the evidences of their superior service qualities, should awaken an intense interest on the part of buyers and users of these commodities.

Probably the most practical and important developments along the line of improving quality, and the betterment of the products used by the sheet-metal trade, have been due to the efforts of the American Sheet & Tin Plate Company, Pittsburgh, Pa., which firm for a number of years has been making these matters a subject of diligent research, and has been conducting service tests of the various materials now in common use. The results of these tests are very important, since actual time and weather determined the measure of service, and likewise the loss from rust and corrosion.

The acid test as a correct measure of corrosion is practically everywhere now regarded as an exploded theory. It is unreasonable to suppose that submitting a product for a few hours to a highly destructive agency should in anywise be regarded as a fair or conclusive proof of its durability when exposed to the natural elements. In contrast to this, the results of actual service tests have proved beyond doubt that many of the widely exploited materials which were supposed to possess exceptional resistance to rust and corrosion are in reality much less durable than copper-bearing steel under the same identical conditions of service.

It is an established fact that scientifically manufactured steel, when alloyed with a certain percentage of copper, possesses remarkable durability and will resist corrosion and the action of the elements to a greater degree than ordinary steel without copper, or those products for which sweeping claims for durability are made, based on the alleged purity of the materials. It now appears that these products are largely dependent for any increased durability on their certain contents of copper rather than on their purity. This has been demonstrated repeatedly under actual service conditions, and also by careful analyses which disclose the fact that they all contain copper to a greater or less degree. The working qualities of copper-bearing steel are likewise important. This material is softer and more ductile, and experience has proved it to be more satisfactorily worked when subjected to severe drawing or forming operations.

As a result of these findings, it is evident that copper-bearing sheets and terne plates are destined to fill a long left want in the sheet-metal trades. It has also been shown that these products are peculiarly adapted for the manufacture of roofing, siding, tanks, and all exposed sheet-metal work, where durability and resistance to the deteriorating influences of weather and soil are highly important factors. It is a matter of note that many leading concerns have already recognized the truth of the claims made for copper-bearing steel, and have adopted it for their requirements. Other users have been investigating and have conducted tests individually, but with practically the same results as obtained by the manufacturers.

Extension of Automatic Telephony in Great Britain.

The British postmaster-general has officially announced that: "After a fairly exhaustive test the Postal Department of the United Kingdom proposes spending $500,000 in establishing automatic telephone exchanges. While the telephonic service of the United States is more efficient than ours, it is not so efficient as ours will be eventually. In this direction it is hoped that this country will soon be able to give a lead both to the United States and Canada. With the co-operation of the postmasters of the United Kingdom the telephone service of the country will eventually be as efficient as the postal and telegraph services."

Latest Approved Fittings

CONDUIT BOXES. — Electrical Fittings Company, Limited, 70 King Street, West, Toronto, Ontario, Canada.

"Diamond B."

Drawn-steel boxes. Catalog Nos. 6350, 5359, 31, 31-L, 40, 41, 45-E, 45-C, 45-H, 6250, 6065, 1915, 3719, 3720, 3722, 3723, 1900, 22, 23, 18, 18-L, 18-A.

"Diamond R."

Cast-iron conduit pipe fittings, one-half to three-inch sizes. Types A, B, C, D, E, F, FS, FSC, FD, FDC, G, H, J, K, LB, LL, LR, P, PC, T, X.

Approved November 3, 1913.

CONDUIT OUTLET BUSHINGS, FITTINGS AND COUPLINGS.— Electrical Fittings Company, Limited, 70 King Street, West, Toronto, Ontario, Canada.

"Diamond R."

Cast-iron conduit pipe fittings, one-half to three-inch sizes. Types A, B, C, D, E, F, LB, LL, LR, T, X.

Approved November 3, 1913.

CONDUIT OUTLET PLATES.— Sprague Electric Works of General Electric Company, 527 West Thirty-fourth Street, New York, N. Y.

"S. E."

Catalog Nos. 6377 and 6425, for use with 0.5-inch rigid conduit.

Approved October 29, 1913.

FIXTURES.—Keystone Type Foundry, Ninth and Spruce Streets, Philadelphia, Pa.

Fixtures shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters and examined at factories and passed by Underwriters' Laboratories, have labels attached to each fixture. This manufacturer is equipped to supply these fixtures so labeled.

Approved October 23, 1913.

HOSPITAL SIGNAL SYSTEM.— The Bryant Electric Company, Bridgeport, Conn.

A special flush switch controls a 125-volt signal-lamp circuit which may be opened by a button and closed by a solenoid forming parts of the switch. The circuit of the solenoid may be closed by a special push-button pendent switch and includes a small, single-pole, glass tube fuse in a special casing. The closing of the circuit by the flush switch is designed to open the circuit of the solenoid and pendent switch.

Approved November 3, 1913.

PICTURE MACHINES AND APPLIANCES.—The Bell & Howell Company, 90 Illinois Street, Chicago, Ill.

"Inductor Compensator," Type B.

A transformer for use in arc-lamp circuits of moving-picture-machine outfits. Primary voltage 110, secondary amperes 35-60.

Approved October 8, 1913.

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

POPCORN-POPPING MACHINE.— Bullis Automatic Vending Company, Flint, Mich.

This device consists of a steel cabinet containing a hopper, a motor-driven, electrically heated, rotary popper, an automatic control switch and an electric light. In the operation of the device a coin is used to release a hand crank, which, when given one complete turn, establishes an electric circuit and releases a measure of corn sufficient to produce one bag of popcorn, after which the operation of the machine is automatic for a predetermined time sufficient to pop the corn. 125 volts, alternating current or direct current, 15 amperes.

Standard when connected by means of proper approved fittings to wiring circuits of suitable capacity for the current required, but not for connection to ordinary lighting circuits nor to ordinary lamp sockets or receptacles.

Approved October 15, 1913.

RECEPTACLES, Standard.—E. H. Freeman Electric Company, Trenton, N. J.

Brass-shell wall sockets.

Key, catalog Nos. 30, 35, 140, 142, 150, 152, 188, 190, 194.

Keyless, catalog Nos. 31, 36, 141, 143, 151, 153, 189, 191-94, inclusive.

Porcelain-shell wall sockets.

Key, catalog Nos. 136, 138.

Keyless, catalog Nos. 137, 139.

Approved November 3, 1913.

RECEPTACLES, Standard. — Pass & Seymour, Incorporated, Solvay, N. Y.

"P. & S." porcelain shell.

Key, 250 watts, 250 volts.

Cleat, catalog Nos. 5, 61087.

Concealed, catalog Nos. 61237, 62247, 62371.

Keyless, 660 watts, 250 volts.

Cleat, catalog Nos. 61087, 62358.

Sign or conduit box, catalog Nos. 285, 427, 61960. Catalog No. 61960 and others ready wired on 4 to 30-inch centers with No. 12 or No. 14 B. & S. gauge rubber-insulated wires.

Concealed, catalog Nos. 60237, 60247, 60371, 61250.

Approved October 16, 1913.

RECEPTACLES, Standard.—Harvey Hubbell, Incorporated, Bridgeport, Conn.

"Hubbell" rosette receptacles, link fuses.

Key, 2 amperes, 125 volts.

Concealed, "Quick Catch," catalog No. 3738.

Cleat, "Quick Catch," catalog No. 3741.

Keyless, 2 amperes, 125 volts.

Concealed, "Quick Catch," catalog No. 3739.

Cleat, "Quick Catch," catalog No. 3742.

Pull, 2 amperes, 125 volts.

Concealed, "Quick Catch," catalog No. 3737; "Lock Shell," catalog No. 35009.

Cleat, "Quick Catch," catalog No. 3740; "Lock Shell," catalog No. 35010.

Approved October 16, 1913.

SWITCHES, Knife.—George Cutter Company, South Bend, Ind.

Types "Paragon" and FF, one, two, three and four-pole, 250-volt, all capacities, 600-volt, 100-amperes.

Approved October 13, 1913.

SWITCHES, Push-Button Flush.— Chapman & Walker, Limited, submittor, 65-69 Victoria Street, Toronto, Canada. Manufactured for the above by Sterling Telephone & Electric Company, Limited, 200 Upper Thames Road, London, England.

Approved September 29, 1913.

SWITCHES, Push-Button Flush.— Gordon Electric Manufacturing Company, 403 Masonic Temple, Chicago, Ill.

The following switches are approved and labeled under conditions stated on card, dated October 14, 1912.

Single-pole, 5 ampere, 250 volts, 10 amperes, 125 volts, catalog No. 9.

Three-way, 5 amperes, 250 volts, 10 amperes, 125 volts, catalog No. 18.

Approved October 29, 1913.

SWITCH BOXES.—Electrical Fittings Company, Limited, 70 King Street, West, Toronto, Ontario, Canada.

"Diamond B."

Sectional steel switch boxes, catalog Nos. 155, 160, 161, 162, 163, 170, 171, 172, SC, SC1, CCS1, CCS3.

Approved November 3, 1913.

WIRES, Rubber-Covered.—Canada Wire & Cable Company, Limited, 1160-70 Dundas Street, Toronto, Canada.

Marking: One red thread woven in the braid.

Standard—National Electrical Code, 1911 Edition.

Approved November 3, 1913.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

MUSCATINE, IOWA.—The Council has voted to have a municipal lighting plant. C.

AUDUBON, IOWA.—The Commercial Club is considering ornamental street lighting. C.

CHERRYVALE KANS.—The Commercial Club at Cherryvale is laying plans for three blocks of "White Way."

CROSBY, MINN.—The Council will soon let contract for laying conduits for the "White Way" lighting system. C.

WAPELLO, IOWA.—The Burlington Railway & Light Company has received a franchise to furnish light to this city.

DAVIS, W. VA.—The Davis Colliery Company will install an additional electric unit, doubling the capacity of the power plant.

MONROE, IND.—The Council is considering ways and means to secure electric lighting. Address the city clerk for particulars.

POYNETTE, WIS.—$4,500 will be expended to build a dam to furnish power for a municipal light plant. Address the city clerk.

WAUKEGAN, ILL.—The Council is planning to have a system of ornamental lighting on Tenth Street. Address the city clerk.

PARK VALLEY, UTAH.—The citizens here are planning to install a $5,000 electric-light plant. Address the town clerk for particulars.

SWEDESBORO, N. J.—A new electric lighting system will be installed here, including the installation of new lines throughout the borough. A.

ALBIA, IOWA.—The City Council is planning to establish an electric-light plant here. Address the city clerk in regard to this project.

AURORA, MINN.—The Village Council is considering enlarging the municipal lighting plant to three or four times its present capacity.

ZANESVILLE, O.—The Council has passed a resolution to issue bonds for $3,000 to construct and install conduit for electric wiring in Main Street.

SOUTH HILL, VA.—The town is planning to purchase and enlarge the water works and electric light plant. Address the town clerk for information.

ELIZABETHTOWN, KY.—Motors will be needed for the operation of a limestone crusher which is to be established by H. O. Williams and Harry Stewart. G.

TOLEDO, O.—Among the prospective large electrical jobs to be let in Toledo in the near future is the equipment for the high-pressure pumping plant. H.

CENTERPORT, PA.—The Council has granted the Hamburg Gas & Electric Company a franchise to erect poles and wires to supply the borough with electricity.

ORRVILLE, O.—Bids on the construction and equipment for the new lighting and power plant will be opened as soon as bonds for $41,000 are sold. A. Jenery is clerk. R.

CLEVELAND, O.—Mayor Baker and his new cabinet members have mapped out plans for immediate completion of the $2,000,000 municipal electric lighting plant.

VALDEZ, ALASKA. — The City Council recently granted to Alfred B. Iles a franchise to erect poles and string light and power lines in the public streets of this city. O.

WATERTOWN, MINN.—James J. Ponsford and Guy Halgren have formed a partnership and will build an electric light plant providing the citizens will patronize the company. C.

SOUTH BEND, IND.—An expert will be employed to make an investigation with a view to opening a municipal lighting plant in this city. Address the city clerk for particulars.

ELKHART, IND.—The Investigating Committee of the Citizen's Light Committee inspected the ornamental lighting at Goshen, Ind. It is proposed to install a new lighting system here.

KERRISDALE, B. C.—The Kerrisdale Rate Payers' Association is advocating the establishment of a municipal light and power plant, with funds to be raised by the sale of a bond issue. O.

CONDE, S. D.—The Conde Light & Power Company has been incorporated with a capital of $15,000. The incorporators are M. Ehrler, Caroline Taylor and George J. Ehrler, all of Conde.

DES MOINES, IOWA.—The Council is considering establishing a municipal light plant to supply electricity for lighting and police and fire station. Address Mayor Hanna for further information. C.

LENNOX, S. D.—The City Council has granted to H. B. Farland and T. K. Coles a franchise to construct and operate an electric light system in this city. The franchise is for a period of 20 years.

PORT CLINTON, O.—Preparations are being made by local authorities for the sale on February 15 of $30,000 worth of bonds for a municipal lighting plant. Address the city clerk for particulars.

BREMERTON, WASH.—W. D. Peters, local attorney, representing promoters of a new electric light company, offers to build a plant to cost $288,000, which will probably absorb the present company. C.

LOUISVILLE, KY.—An electric elevator will be purchased for installation in a new building which is being designed by Brinton B. Davis, of Louisville, Ky., for James E. Gamble, of that city. G.

SEATTLE, WASH.—An appropriation of $20,000 has been made for installing heavier electrical apparatus at the substation of the municipal light and power plant at Seventh Avenue and Yesler Way.

NASHVILLE, TENN. — Erwin Electric Light & Power Company has been incorporated with a capital of $15,000. The incorporators are J. Fred Johnson, T. H. Morris, J. J. McLaughlin, John A. Muse and H. G. Morrison.

CLEVELAND, O.—Sealed bids will be received at the offices of Director of Public Service Springborn until December 10 for furnishing and maintaining street lighting current. W. H. Kirby is secretary, 204 City Hall.

SAANICH, B. C.—The City Council is considering the installation of a street-lighting system to cost $37,500, and to be supplied by the British Columbia Electric Company. The matter will be definitely settled in the immediate future. O.

YOUNGSTOWN, O.—Application has been made by the Mahoning County Light Company for permission to issue bonds to finance the construction of a plant. The company has just been incorporated and organized with Michael Liebel as president. R.

ALTOONA, PA. — The Borough Council of Juniata, a suburb of this city, has awarded a 40-year franchise for electric lighting to the Raystown Water Company. The company pays for the privilege a bonus of $5,000 when its lines are established. N.

COEBURN, VA.—The Coeburn Light & Power Company is planning to purchase and install several transformers and 2,000 feet of No. 10 copper wire and 5,000 feet No. 14 copper wire. Address, Claude H. Cox, manager, in regard to these purchases.

MASON CITY, IOWA.—The People's Gas & Electric Company, and the Mason City & Clear Lake Railway Company, owned and operated by the United Light & Power Company of Chicago, has announced that they will expend $200,000 on improvements.

ATCHISON, KANS. — A central power plant, to cost at least $250,000, will be built in Atchison, if tentative plans announced by officials of the McKinley Syndicate are carried out. Address H. E. Chubbuck, general manager, Peoria, Ill., for desired information.

ERIE, ILL.—The village board has granted a 25-year franchise to the Illinois Northern Utilities Company to operate an electrical distributing system. The board also awarded the company a 10-year contract to light the village streets. The contract includes power for pumping water for the village. Z.

BARBERTON, O.—The Council has adopted a resolution permitting the Director of Public Service to purchase real estate for the purpose of erecting a substation for the municipal electric light plant. Bids for equipment will be opened soon. William S. Mitchell is mayor. R.

EARLVILLE, ILL. — The City Council is contemplating the installation of a new electric-lighting system for the streets and recently made an inspection of the system used at Amboy. The Illinois Northern Utilities Company, District Superintendent Danielson, Mendota, is interested. Z.

HUGO, OKLA.—The property of the Hugo Ice & Light Company has been purchased by the American Public Service Company of New York. Extensive improvements are to be made to the plant, it is announced by H. E. Mole, of New York, chief engineer of the company. D.

LOCKPORT, N. Y.—E. B. Reed, of Lockport, is endeavoring to interest Falls men in his plan to develop 30,000 electrical horsepower at Lewiston by constructing a tunnel from the Whirlpool to the Lewiston escarpment. Plans are to organize a company immediately and seek a franchise to develop power.

FRUIT RIDGE, CAL.—The people of the Fruit Ridge district desire a lighting system as shown by a petition recently circulated by J. H. Williams. The Sutter Improvement Club has taken the initiative in this matter and will see that an election shall be called by the supervisors to determine whether or not a lighting system shall be installed.

MONTAGUE, MASS.—The Turner's Falls Power Company is planning to build a 50,000 horsepower hydroelectric station here within the next few years. The initial development will total 30,000 horsepower, and is to be completed early in 1915. William B. Durant is in charge of the engineering for the Turner's Falls Company.

DOWNERS GROVE, ILL.—The village trustees have decided to enlarge the municipal power plant and will receive bids for two 100-horsepower fuel-oil engines; two 100-kilowatt 2,300-volt alternating-current generators; a three-panel switchboard; two two-stage centrifugal pumps and two deep-well motor-driven pumps. Specifications may be obtained from H. A. Gardiner.

LOUISVILLE, KY.—Directors of the Louisville Gas & Electric Company have approved a plan to spend between $400,000 and $500,000 in enlarging the capacity of the company's principal power plant from 6,000 kilowatts to 14,000 kilowatts. In addition eight 500-horsepower boilers and auxiliary equipment will be installed. Detailed plans are now being drawn, and work on the addition will begin early in 1914. G.

CLEVELAND, O.—Approximately 15 miles of overhead wiring will be placed under ground by public utility corporations next year, according to schedules submitted to Director of Public Service W. J. Springborn and the Council Investigating Committee. The Cleveland Electric Illuminating Company scheduled a total of 28,430 feet; the Cleveland Telephone Company, 5.05 miles, and the Cuyahoga Telephone Company, 5.22 miles. R.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

EXIRA, IOWA.—The system of the Exira Telephone Company is to be rebuilt within a short time. C.

OSCEOLA, IOWA.—The Farmers Mutual Telephone Company plans to install a complete modern equipment.

BUFFALO, N. Y.—The Federal Telephone & Telegraph Company will erect a $12,000 telephone exchange at 305 Elmwood Street.

GRAHAM, MO.—The People's Telephone Company has been incorporated with a capital stock of $6,510 by G. M. McNeill, O. L. Mowrey and others.

PORTLAND, ORE.—The Pacific Telephone and Telegraph Company will expend $50,000 for improvements and repairs to the plants and cable systems in the business districts.

VIRGINIA, MINN.—Extensive improvements are to be made in the service of the Virginia Exchange of the Mesaba Telephone Company, according to Fred E. Lister, superintendent.

NEW WESTMINSTER, B. C.—The British Columbia Telephone Company has been granted permission by the City Council to erect a pole line and string wires on certain streets of this city. Construction work will begin at once. O.

MINNEAPOLIS, MINN. — The Northwestern Telephone Exchange Company announces that work will be begun immediately on a new exchange to be located in the Minnehaha district, the cost of which is estimated at $300,000.

RICHLAND, WASH.—The Yakima & Columbia River Telephone Company was recently organized by farmers living in the Richland Valley. The company is capitalized at $2,500. Richland will be the principal place of business. E. E. Floyd is president of the company. O.

McALESTER, OKLA.—Elmer Speaker, local manager, announces that the Pioneer Telephone & Telegraph Company will begin work soon on rebuilding the plant in this city. An appropriation of $38,000 has been made for the work, which will require several months.

JERSEY CITY, N. J.—The Board of City Commissioners, through Frank Hague, Commissioner of Public Safety, is considering improvements in its fire-alarm system to cost about $10,000. The work will primarily consist of the installation of about 70 improved type signal boxes. A.

CENTRALIA, WASH.—The Lewis County Commissioners recently granted a franchise to the Salzer Valley Telephone Company for the construction of a telephone line in the Salzer Valley, east of Centralia. Abe Crabbs is president of the company, and H. C. Moffatt, secretary.

MUNFORD, TENN.—The Home Telephone Company has been incorporated with a capital of $2,000. The incorporators are J. G. McCain, J. F. Wooten, A. H. Yarbrough, S. H. Bass and C. T. Strong. The company's plan is to take over the present telephone exchange at Munford, which is now being operated by the Cumberland Telephone Company, and to extend its operations throughout the adjacent country.

ELECTRIC RAILWAYS.

(Special Correspondence.)

LIMA, O.—A company, capitalized at $100,000, has been organized by Lima citizens to build a street car line to compete with the city railway.

WATERTOWN, S. D.—The Commercial Club has appointed a committee headed by Lee Stover to work on a project for an electric line to Lake Kampeska. C.

TACOMA, WASH.—A special election will be held here on December 30 for the purpose of voting $87,000 worth of bonds to construct and maintain a municipal street car line.

ELIZABETHTOWN, PA.—An ordiance has been passed by the Council for a new trolley line between Hershey and Elizabethtown. Address J. E. Snyder for particulars.

OLYMPIA, WASH.—Articles of incorporation have been filed for the Tacoma Transit Company, with a capital stock of $30,000, by J. Grant Hinkle, George Everett, and others.

GREEN BAY, WIS.—An electric line between here and Sturgeon Bay is a certainty. Promoters plan to have the line run as far as Ephriam. E. E. Galle & Company, Minneapolis, are the promoters. C.

BROOKSVILLE, FLA. — The Brooksville Interurban Railway Company has been organized here with a capital stock of $100,000, and will build trolley lines to Lake Stafford. H. D. Evans is president.

RACINE, WIS.—The Commercial Clubs of Racine and Burlington plan to appoint a committee to confer with the Milwaukee Electric Railway & Light Company and urge the construction of an electric line between the two cities. Z.

WATERTOWN, ILL.—The Tri-City Railway Company has secured options on a right of way for an interurban line for the greater distance between Watertown and Port Byron. Actual work will be started next spring.

SHARON, PA.—Tentative plans for the construction of a traction line connecting this city with Cleveland are being discussed. Members of the Sharon Civic Association are interested. Address the City Clerk for information.

JEFFERSON CITY, MO.—The Jefferson Street Railway Company has filed certificates for increased powers to operate its road in Callaway, Boone and adjacent counties. According to persons who profess to know, this means an interurban road from Jefferson City to Columbia.

HOUSTON, TEX. — The Sunset Heights street car line, extending from Houston Avenue, four miles north to Sunset Heights, will be constructed at once and should be in operation by April 1, 1914, according to a statement made by David Daly, general manager of the Houston Electric Company.

SUDBURY, ONT.—An application has been made in Canada for the incorporation of Sudbury, Kepawa & Bell River Railway, which plans to build lines from Sudbury to different points touching at Lake Temiskaming and connecting with the National Transcontinental Railway at a point where that line crosses the Bell River.

SAN FRANCISCO, CAL. — The Board of Public Works has been authorized by the Finance Committee of the Supervisors to invite proposals for furnishing the city with cars, rails and other materials recently reported by City Engineer O'Shaughnessy to be necessary for the municipal railway extension work, the cost of which he estimates at $1,280,000.

EDGEFIELD, S. C.—The Chamber of Commerce is considering a proposition to build an electric railroad from Eastey, S. C., *via* Anderson, Abbeville, Greenwood or McCormick, Edgefield to Augusta, a distance of about 140 miles. The proposition has been under consideration for several months and much work has been done by all of the towns named in a very quiet manner.

NEW BEDFORD, MASS. — The Union Street Railway Company has petitioned for authority to issue $250,000 in bonds. The purpose of the bond issue, in addition to paying the funded debt, is to provide means of making extensions of the railway, building power houses, car barns and park buildings, acquiring or equipping additional rolling stock and making permanent investments or improvements.

CHILLICOTHE, MO.—H. L. Gilbert and David Miller, of Kansas City, are planning an interurban line to connect Chillicothe and Kansas City. They are asking Hamilton and Kingston for a franchise for an electric light and power plant and an electric railway to connect the two towns, which are nine miles apart. There is another proposition to connect Chillicothe with Cainsville by electric line pending. Fred Morch is the promoter of the latter project.

MARION, ILL.—The Southern Illinois & St. Louis Railway Company has filed a charter with the circuit clerk of Williamson County to build an electric railway from Marion to Harrisburg in Saline County, another line north to Benton and a spur to Johnston City and Herrin. The capital stock is $2,500. The incorporators are William Rothman, William M. Klein, Samuel Kraus and Thomas G. Deering, all of Chicago, and Harold E. Higginson, of Elmhurst. Z.

LA CROSSE, WIS.—It is rumored that there is a scheme afoot to build an electric line from Hatfield to La Crosse, *via* Black River Falls, by the Wisconsin Railway, Light and Power Company. President C. C. Smith, of Milwaukee, recently intimated that the disposal of $1,200,000 bonds, now held by the N. W. Halsey Company, Chicago, will result in big improvements and the acquisition of other utilities. One plan projected is an interurban to Black River Falls from La Crosse. An effort is being made to interest La Crosse capital.

ATCHISON, KANS.—There is a rumor that something is to be done along the line of establishing a chain of interurban railroads here. There is a well founded report that the McKinley interests are planning to install a new power house in Atchison within the next year. It was reported that work on the project would be commenced early in the spring. The improvements will cost fully $200,000 and should the interurban deal go through the expenditures would exceed $500,000. It is said that the syndicate is considering the advisability of an interurban line which would be operated from Atchison to Topeka and St. Joseph. An investigation of the financial soundness of such a line is being made now, it is understood.

FOREIGN TRADE OPPORTUNITY.

(Where addresses are omitted they may be obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C. In applying for addresses refer to file number.)

NO. 12,055. CRANES.—The Swansea Harbor Trustees, Swansea, Wales, invite tenders for the supply, delivery, and erection at site complete of three portable hydraulic or electric cranes, with fixed jibs, and also three portable hydraulic or electric cranes, with jibs fitted with compensating luffing gear. Instructions to bidders, contract, specifications, and conditions may be obtained upon application to the Harbor Board.

NEW PUBLICATIONS.

IBERICA.—The Observatorio del Ebro, Tortosa, Spain, has begun the publication of a scientific review entitled *Iberica*, the preliminary number having been issued in October. The regular issues will begin in January, 1914, and will deal with progress in science and its applications.

WALLINGFORD REPORT.—The Board of Electrical Commissioners has published a report of the Borough Electric Works, of Wallingford, Conn., for the year ended July 31. This is accompanied by a report on the examination of the works and an appraisal of the property by a certified public accountant. The superintendent of the plant is Alfred L. Pierce.

PROPOSALS.

ELECTRIC FURNACE. — Sealed proposals will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until December 30, for furnishing electric furnaces, as per Schedule 6,081, for delivery at the Navy Yard, Puget Sound, Wash.

ELECTRIC FREIGHT ELEVATOR.—Sealed proposals will be received at the office of the Coast and Geodetic Survey, Washington, D. C., until December 8 for furnishing an electric freight elevator in accordance with specifications, copies of which may be obtained by addressing the Superintendent.

LIGHTING AND FIXTURES.—The Board of Contract and Supply, Hartford, Conn., is advertising for sealed proposals for an ornamental lighting system, including furnishing the current for a term of years ending June 1, 1919. The installation is to be completed by June 1, 1914. Plans and specifications may be obtained from the Board of Street Commissioners.

ELECTRIC CONDUIT AND WIRING AND INTERIOR LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until January 6 for the electric conduit and wiring and interior lighting fixtures of a one-story building for the post office at Grand Junction, Colo.; and until January 7 of a one-story building for the post office at Salem, O., in accordance with drawings and specifications, copies of which may be obtained from the custodians of the sites named or the Supervising Architect.

FINANCIAL NOTES.

The Keokuk Electric Company has increased its capital stock from $650,000 to $900,000.

Stockholders of the Central District Telephone Company, at a meeting Tuesday, authorized an increase in the company's stock from $15,000,000 to $25,000,000 and also authorized a bond issue of $25,000,000.

The American Gas & Electric Company announces the issue of $500,000 additional common stock. The holders of record on November 28 of common stock and voting trust certificates for common stock will be entitled to subscribe for one share of such new common stock for each six shares then owned.

United Electric Tramways of Montevideo will issue at par 10,000 preference shares of £5 each and 19,800 ordinary shares of £5 each. The proceeds of the new capital are to be used in erecting and equipping two substations, new car barns, extensions and additions to property and for purchase of new equipment.

A special meeting of stockholders of the Fresno, Hanford & Summit Lake Interurban Railway Company has been called in Fresno, Cal., for December 18, for the purpose of increasing the capital stock of the company from $1,250,000 to $1,475,000. The new stock will be seven-per-cent preferred.

Shareholders of the West End Street Railway at their annual meeting authorized an increase of 7,000 shares in common stock, par $50, raising common capital from $12,730,160 to $13,080,150. Proceeds are to repay the Boston Elevated amounts expended by it for permanent additions, alterations and improvements on property of the West End Company. Directors were unanimously re-elected.

Richard G. Marsh, of Warsaw, Ill., promoter of the proposed interurban road from Burlington to St. Louis, announces that at a recent meeting held in Philadelphia the financiers of the road decided to raise the bond issue from $3,000,000 to $5,000,000, which Marsh says will be sufficient to build and equip the road, and that work on East St. Louis extensions will be commenced immediately.

The Federal Light & Traction Company has called a meeting of stockholders for December 12 to approve an authorized issue of $10,000,000 seven-per-cent 10-year notes of which $725,000 are to be offered presently to stockholders at par and interest. Also to approve an underwriting agreement between the directors and the firms of which the directors are members to take such notes as are unsubscribed for. The notes now issued are convertible into common stock of the company at par at any time prior to December 1, 1923. Notes will be dated December 1, 1913, with the Columbia-Knickerbocker Trust Company as trustees and callable at 105 and interest on 30 days' notice.

Approval was given by the State Corporation Commission of Virginia to the merger of the Redland Power Company and the Charlottesville & Albemarle Railway Company. The new company is to be known as the Charlottesville & Albemarle Railway Company. Its first officers will be T. C. Todd, of Baltimore, president; John L. Livers, vice-president; Norman James, treasurer; George S. Walker, assistant treasurer, and E. E. Starke, secretary. The authorized capital stock of the merged company is placed at $700,000, of which $200,000 is to be preferred and $500,000 common. A bond issue of

$750,000 to take up all present bonded indebtedness is also authorized.

Dividends.

California Railway & Power Company: its regular quarterly dividend of 1.75 per cent on its prior preference stock, payable January 2, 1914, to stockholders of record December 20, 1913.

Chicago Telephone declared the regular quarterly dividend of $2 a share, payable December 31 to stock of record December 30.

Electric Properties Corporation has declared the regular quarterly dividend of 1.5 per cent on the preferred stock, payable December 10, to stockholders of record December 1.

General Gas & Electric Company: regular quarterly of 1.5 per cent on the preferred stock, payable January 2 to stock of record December 20.

Mackay Companies: regular quarterly of one per cent on the preferred and 1.25 per cent on the common, payable January 2 to stock of record December 13.

Massachusetts Electric Company; regular semi-annual of $2 on the preferred stock, payable January 1 to stock of record December 6.

New York Edison Company; the regular quarterly dividend of 1.5 per cent, payable December 13.

Philadelphia Company; the regular quarterly dividend of 1.75 on the common stock, payable February 2 to stock of record January 2.

West Penn Traction & Water Power Company; regular quarterly of 1.5 per cent on the preferred stock, payable December 15 to stock of record December 9.

Reports of Earnings.

PHILADELPHIA RAPID TRANSIT.

	1913.	1912.
October gross	$2,113,530	$2,093,814
Net	902,892	854,174
Surplus after charges.	106,292	95,053
Four months gross	8,079,518	7,851,893
Net	3,366,324	3,182,907
Surplus after charges.	171,077	146,464

CITIES SERVICE COMPANY.

	1913.	1912.
October gross	$ 162,468	$ 103,654
Net after expenses	137,881	98,364
Preferred dividends	63,539	50,964
Common dividends	33,559	18,313
Surplus after dividends	40,782	29,086
Twelve months gross.	1,649,877	1,176,926
Net after expenses	1,499,168	1,085,819
Preferred dividends	737,044	593,696
Common dividends	372,104	206,742
Surplus after dividends	390,020	285,379
Accumulated surplus, October 31, 1913, $922,904		

MANILA ELECTRIC RAILROAD & LIGHTING CORPORATION.

	1913.	1912.
August gross	$ 142,725	$ 131,953
Net after taxes	75,935	69,247
Surplus after charges	43,781	37,106
Eight months gross	1,664,059	1,549,421
Net after taxes	884,174	860,364
Surplus after charges	498,324	474,664

TEXAS POWER & LIGHT.

	1913.	1912.
October gross	$ 111,133	$ 89,876
Net after taxes	41,352	37,588
Surplus after charges.	20,247	23,053
Twelve months gross.	1,099,877	946,180
Net after taxes	412,439	390,169
Surplus after charges.	227,831	287,472
Balance after preferred dividends	118,281	269,972

VIRGINIA RAILWAY & POWER.

	1913.	1912.
October gross	$ 445,821	$ 408,326
Net	223,420	203,653
Other income	8,302	6,234
Total income	231,722	209,887
Surplus after charges.	96,760	85,162
Four months gross	1,739,297	1,619,360
Net	857,212	801,826
Other income	32,634	30,129
Total income	889,847	831,955
Surplus after charges.	356,959	335,840

LOUISVILLE RAILWAY.

	1913.	1912.
October gross	$ 281,485	$ 275,458
Net after taxes	122,582	120,426
Surplus after charges	52,415	54,425
Income from interurban	15,774	20,889
Total for dividends.	68,189	75,314
Ten months gross	2,690,011	2,601,695
Net after taxes	1,141,779	1,108,456
Surplus after charges	444,279	461,122
Income from interurban	166 379	195,656
Total for dividends.	610,658	656,778

AMERICAN GAS & ELECTRIC.
(Five Subsidiaries.)

October gross	$ 234,972	$ 200,281
Net after taxes	128,435	105,276
Surplus after charges.	84,352	67,772
Twelve months gross	2,493,694	2,178,807
Net after taxes	1,306,623	1,087,203
Surplus after charges.	807,137	656,649

PACIFIC POWER & LIGHT.

	1913.	1912.
October gross	$ 107 357	$ 103,679
Net after taxes	55,593	51,063
Surplus after charges.	25,338	26,342
Twelve months gross	1,259,089	1,229,047
Net after taxes	608,398	610,961
Surplus after charges.	278,213	308,286
Balance after preferred dividends	44,463	124,536

WISCONSIN GAS & ELECTRIC.

	1913.	1912.
October gross	$ 67,619	$ 58,239
Net after taxes	20,577	19.515
Surplus after charges.	11,677	10,642
Ten months gross	613,139	555,608
Net after taxes	166,379	169,379
Surplus after charges*.	77,338	81,342
Balance after dividends	32,338	44,592

*Equivalent to annual rate of 8.08 per cent on common stock.

LEHIGH VALLEY TRANSIT.

	1913.	1912.
October gross	$ 145,647	$ 126,734
Net	90,298	77,538
Surplus after charges.	43,287	34,975
Twelve months gross	1,758,650	1,479,383
Net	1,021,828	839,892
Surplus after charges.	469,740	340,808

CONSOLIDATED CITIES LIGHT, POWER & TRACTION.

	October	10 Months.
Gross earnings	$ 61,517	$ 652,552
Net after expenses	60,524	640,484
Surplus after charges.	27,163	329 564
Balance after dividends	16,329	221.231
Accumulated surplus Oct. 31, 1913, $93,773.		

DETROIT EDISON.

	1913.	1912.
October gross	$ 495,719	$ 389,624
Net	204,408	161.501
Surplus after charges.	143,924	102,013
Balance after depreciation	94,244	60,613
Ten months gross	4,434.124	3,468,215
Net	1,807,007	1,428,860
Surplus after charges.	1,235,660	839,800
Balance after depreciation	814,134	474,560

SPRINGFIELD RAILWAY & LIGHT.

	1913.	1912.
October gross	$ 53,736	$ 49,755
Net after taxes	22,834	24,042
Surplus after charges.	13,539	15,261
Twelve months' gross	611,366	567,889
Net after taxes	290,061	257,241
Surplus after charges.	178,076	158,597

KANSAS GAS & ELECTRIC.

	1913.	1912.
October gross	$ 78,084	$ 66,980
Net after taxes	28,628	23,621
Surplus after charges.	13,470	9,453
Twelve months gross.	996,216	1,015,264
Net after taxes	352,699	355,757
Surplus after charges.	179.702	203,289
Balance after preferred dividends	74,702	98,289

UTILITIES IMPROVEMENT COMPANY.

	October.	10 Months.
Gross earnings	$ 151,661	$1,433,502
Net after expenses	146,916	1,405,302
Preferred dividends	85,000	850,000
Common dividends	22,500	225,000
Surplus after dividends	39,416	330,302

Accumulated surplus to October 31, 1913, $620,052.

PORTLAND RAILWAY, LIGHT & POWER.

	1913.	1912.
October gross	$ 574,524	$ 565,839
Net after taxes	295,885	282,810
Surplus after charges.	121,626	133,519
Twelve months gross.	6,697,741	6,582,920
Net after taxes	3,379,937	3,314,758
*Surplus after charges.	1,420,077	1,593,378

*Equivalent to 5.7 per cent on the common stock.

BANGOR RAILWAY & ELECTRIC.

	1913.	1912.
October gross	$ 68,454	$ 62,964
Net after taxes	40,516	36,191
Surplus after charges.	23,162	19,158
Twelve months gross.	755,084	692,630
Net after taxes	411,814	382,251
Surplus after charges.	204,359	189,007
*Balance after preferred dividends	99,359	84,007

*Equivalent to 5 per cent on the common stock.

WASHINGTON, BALTIMORE & ANNAPOLIS.

	1913.	1912.
October gross	$ 67,026	$ 65,905
Net after taxes	30,986	32.587
Surplus after charges.	6,723	9,788
Ten months gross	695,397	650,372
Net after taxes	122,582	120,426
Surplus after charges.	111,759	109,289

AMERICAN POWER & LIGHT.
(Subsidiary Companies)

	1913.	1912.
October gross	$ 510,237	$ 450,674
Net earnings	240,288	201,596
Six months' gross	2,796,241	2,631,489
Net earnings	1,308,663	1,125,422
Twelve months' gross.	5,725,372	5,296,489
Net earnings	2,589,147	2,368,985

CUMBERLAND COUNTY POWER & LIGHT.

Cumberland County Power & Light System reports earnings for the twelve months ended October 31, 1913, as follows:

Gross	$2,306,150	$2,109,284
Net after taxes	1,019,890	883,380
Surplus after charges.	319,749	252,094
Balance after preferred dividends	*193,749	184,594

*Equal to 7.17 per cent on the outstanding common stock.

EAST PENNSYLVANIA GAS & ELECTRIC COMPANY.

	1913.	1912.
October gross	$ 6,311	$ 6,290
Net	2,555	1,912
Ten months' gross	56,284	55,272
Net	22,407	20,179

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Dec. 1.	Nov. 24.
American Tel. & Tel. (New York)	120⅜	118½
Commonwealth Edison (Chicago)	128	128¼
Edison Electric Illuminating (Boston)	261	260
Electric Storage Battery common (Philadelphia)	47	45
Electric Storage Battery preferred (Philadelphia)	47	45
General Electric (New York)	136½	139
Kings County Electric (New York)	119	119
Manhattan Transit (New York)	1⅛	1⅛
Massachusetts Electric common (Boston)	10½	11
Massachusetts Electric preferred (Boston)	64½	65
National Carbon common (Chicago)	130	130
National Carbon preferred (Chicago)	112	112
New England Telephone (Boston)	133½	133
Philadelphia Electric (Philadelphia)	22½	22
Postal Telegraph and Cables common (New York)	77¼	78
Postal Telegraph and Cables preferred (New York)	64	64½
Western Union (New York)	62½	62½
Westinghouse common (New York)	63⅞	63⅞
Westinghouse preferred (New York)	112	112

*Last price quoted.

PERSONAL MENTION.

MR. C. R. LURTON has been appointed manager for the Central Illinois Public Service Company at Auburn, Ill.

MR. A. A. GRAY, general manager of the Electrical Review Publishing Company, was elected president of the Chicago Trade Press Association at a meeting of that organization held on December 1.

MR. THOMAS W. KENNEDY has resigned as secretary and assistant treasurer of the Louisville Gas & Electric Company to enter other business. MR. WILLIAM H. CRUTCHER, superintendent of the gas department, has also resigned, and will be succeeded by MR. W. M. WALSH, of Oklahoma City, Okla.

MR. H. W. YOUNG, president of the Delta-Star Electric Company, Chicago, Ill., addressed the Public Service Section of the National Electric Light Association at the Chicago meeting on November 25, his subject being "High-Tension Weatherproof Switching and Protective Equipment." The paper was illustrated by 42 lantern slides of working installations.

MR. E. R. KELSEY, advertising manager of the Toledo Railways & Light Company, was recently appointed a member of the Committee on Passenger Traffic by the Transfer and Traffic Association of the American Electric Railway Association. This committee consists of five members representing the five principal electric traffic centers of the country and will meet in New York City three times a year, the next conference taking place on January 1, 1914.

MR. H. C. FOSS, who has been acting manager of the Savannah Electric Company, Savannah, Ga., for several months, has been appointed permanent manager. This is a well earned promotion for Mr. Foss, who is considered one of the most capable men in the Stone & Webster service. Since being in Savannah Mr. Foss has made a large circle of friends and the announcement of his appointment as permanent manager will be very gratifying news. MR. M. L. SPERRY, formerly manager in Savannah for several years, will make his future home in Boston, Mass., remaining associated with the Stone & Webster interests.

MR. J. E. LATTA, associate editor of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, resigned on December 1 to join the staff of the Underwriters' Laboratories of Chicago. Mr. Latta is a native of North Carolina and a graduate of the University of North Carolina and of the Graduate School of Harvard University. He studied engineering for a time at the Polytechnic Institute of Brooklyn, N. Y., at Stevens Institute of Technology, Hoboken, N. J., and in the shops of the Westinghouse Electric & Manufacturing Company, and Hooven, Owens, Rentschler Company, Hamilton, O. He was elected general manager of the Durham (N. C.) Traction Company in 1903, but declined this position in order to become assistant professor of physics in the University of North Carolina. He was acting head of the department of physics and applied electricity for a year and a half, when he was appointed professor of electrical engineering. He stayed here until 1909, in the meantime being engaged as a supervising and consulting electrical engineer in various parts of the country. He entered the employ of the General Electric Company at Harrison, N. J., in 1909, where for seven months he had charge of the course in applied electricity and illuminating engineering, conducted by the company for its employes. He then took up electric power-plant construction and operation in the Southwest until the summer of 1911, when he became technical editor of *Electrocraft*, then published at Detroit. With the purchase of the latter publication by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, Mr. Latta became an associate editor on the staff of this publication. His attention was devoted mainly to the sections of the publication concerning electrical contracting and electrical inspection. Mr. Latta is one of the best informed men in the country concerning the requirements of the National Electrical Code, the use of approved material, and the practical and engineering features of electrical construction. He becomes special agent for the Underwriters'

J. E. Latta.

Laboratories, and will make his headquarters at Chicago. He leaves this publication to the great regret of the publishers and with the best wishes of his employers and his associates, who have grown to regard him very highly not only for his mental attainments, but for his fine congenial spirit and all-around qualifications as a good man to know. Just before leaving, his associates presented him with a handsome travelling case, as a token of their esteem.

OBITUARY.

MR. HENRY M. RICHARDS, chairman of the Board of Directors of the Washington Water Power Company, Spokane, Wash., died at his home on November 17, from concussion of the brain, the result of an accident a few days before.

MR. THOMAS E. HEFFREN, who for many years was manager of the branch office of the Postal Telegraph-Cable Company at 49 West Thirtieth Street, New York City, died suddenly at his home on the 26th ult. Mr. Heffren was afflicted with heart disease.

MR. ALFRED H. PEASE, president of Hart & Hegeman Manufacturing Company, Hartford, Conn., died at his home on Thursday evening, November 27, from heart failure. Mr. Pease was born on Charter Oak Place and was 49 years old. He was a son of Henry Pease and Anne (Church) Pease. He graduated from the Hartford High School in the class of 1882, after which he entered the employ of W. F. Pelton & Company, and was with that firm ten years. He became treasurer of the Hart & Hegeman Company in 1892 and a few years later was made president of the company. During his service as president the large factory on Capitol Avenue was built and the business of the company greatly increased. Mr. Pease is survived by his wife; four children, Dwight A., A. Morgan, Helen E. and Marion C. Pease; three brothers, Charles A. Pease, William C. Pease, Edward H. Pease, and one sister, Miss Laura B. Pease.

NEW INCORPORATIONS.

DES MOINES, IOWA.—Electric Sign & Advertising Company has been incorporated with a capital stock of $10,000 by F. J. Whittemore and W. R. Marshall.

CAMPBELLSVILLE, KY. — The Campbellsville Public Utilities Company has been incorporated with a capital stock of $25,000 by T. M. Estes, of Lebanon, and others.

WILMINGTON, DEL.—George Allen Mullen Co. has been incorporated to carry on the business of electrical engineers and the manufacture of electrical engines. The capital stock is $50,000.

BURLEY, IDAHO.—Articles of incorporation have been filed by the Star Electric & Power Company, capitalized at $10,000, with J. P. Puckett, Harry H. Shellington and Jay M. Shriver as incorporators.

MINNEAPOLIS, MINN.—Despatch Manufacturing Company, makers of the well known Despatch electric ovens, has been incorporated under the laws of Minnesota, with an authorized capital of $50,000.

NEW YORK, N. Y.—Electric Porcelain Products Company, Incorporated, has been incorporated, capitalized at $1,000. The incorporators are Merion J. Higgins, Vitalis Himmer, Jr., and Willis L. Sawyer.

ROCHESTER, N. Y.—Green, Ward & Weber, Incorporated, has been granted articles of incorporation, capitalized at $10,000. The incorporators are Ralph D. Ward, Alfred L. Green and J. Fred Weber, all of Rochester.

CHICAGO, ILL.—Petschel Storage Battery Company has been incorporated with a capital of $31,000, to manufacture and sell electrical batteries, electrical novelties, etc. The incorporators are R. A. Rische, G. M. Merker and H. L. Wuerffel.

DATES AHEAD.

American Institute of Chemical Engineers, New York, N. Y., December 10-13.

American Association for the Advancement of Science. Annual meeting, Atlanta, Ga., December 29-January 2, 1914.

Northwestern Cedarmen's Association. Annual convention, January 6, 1914.

South Dakota Independent Telephone Association, Sioux Falls, S. D., January 14-15, 1914.

Wisconsin Electrical Association. Annual convention, Milwaukee, Wis., January 15-16, 1914.

Western Association of Electrical Inspectors. Annual meeting, Cincinnati, O., January 27, 1914.

With the Electrical Manufacturers

G. M. Gest, the well known conduit engineer and contractor, announces the removal of his executive office to Suite 1330-1336 Woolworth Building, New York, N. Y.

The Electric Storage Battery Company, Allegheny Avenue and Nineteenth Street, Philadelphia, Pa., has issued bulletin No. 142. This is entitled "Lead Battery Developments During 1913 for Electric Vehicles," and is a reprint of a paper presented by Bruce Ford before the recent Chicago convention of the Electric Vehicle Association of America.

Fort Wayne Electric Works of General Electric Company, Fort Wayne, Ind., has issued bulletin No. 1147, which brings all of the information respecting Fort Wayne transformers of the type A up to date. The bulletin is well illustrated with exterior and interior views of the transformers, of their coils and of their connections and also contains dimension diagrams and full data.

Line Material Company, South Milwaukee, Wis., a few months ago began the publication of the *Kyle Line Magazine.* This is edited by David Gibson and contains, in the last issue out, no less than 24 pages from his pen containing his characteristic virile comments on matters of general interest. A few pages of the magazine are devoted to some of the new Kyle line street-lighting fixtures.

Joseph Dixon Crucible Company, Jersey City, N. J., announces that a limited number of booklets dealing with steam traps, unions for steam pipes, feeding graphite for lubricating purposes, etc., are still on hand and will gladly be sent to any engineers interested on application to the company. These booklets were prepared by W. H. Wakeman, who is well known as a writer on practical engineering problems. Each booklet contains numerous illustrations.

The Edward E. Cary Company, Incorporated, 30 Church Street, New York, is the sole importer of "Prima" enameled steel reflectors for electric fixtures and Mazda tungsten lamps. An interesting bulletin which has just been published illustrates and describes a number of these fixtures. Copies may be had upon request. The company is also the importer of "Monopel" inner globes, copper-wire specialties, English rotor and stator and armature disks ready for assembling, and other products of foreign manufacturers which, under the Underwood tariff, are now available for the American market.

Edison Storage Battery Company, 1023 Lakeside Avenue, Orange, N. J., has issued an interesting 24-page pamphlet illustrating and describing the use of the Edison battery in industrial transportation. A large variety of storage-battery-driven industrial trucks, baggage trucks, industrial railway locomotives, mining locomotives, freight trucks, tractors, locomotive cranes, etc., are shown and briefly described. Each of these is equipped with the Edison battery. Near the end of the pamphlet are given valuable data and tray dimensions of Edison storage batteries. A description of the battery is also given.

The Canadian H. W. Johns-Manville Company, Limited, announces the removal of its Toronto branch to more spacious quarters at 19 Front Street, East. This new store and warehouse has a floor area of approximately 35,000 square feet, and is situated in the heart of the wholesale district. In the new quarters the firm will be able to carry a larger stock and have ample space for the display of its complete line of asbestos roofings, packings, pipe coverings, building materials, electrical and railroad supplies, automobile and plumbing specialties, etc. The entire building will be lighted by the Frink and J-M Linolite system of lighting and one room will be used for exhibiting this type of lighting equipment .

Detroit Fuse & Manufacturing Company, Detroit, Mich., has issued catalog No. 22. This is a large 28-page publication devoted to Detroit Ironclad sealable entrance switches, Ironclad fused switches, Arkless indicating inclosed fuses, Arkless automobile fuses, cutouts, terminals, clips, etc. The catalog has a very interesting preface devoted to industrial safety. Each of the products is described and well illustrated both with half-tone and line cuts. Dimension diagrams and full data are included. Separate leaflets have also been issued by the company devoted to its Arkless indicating inclosed fuses and to the Detroit Ironclad fused switch. The latter has a very striking but tragic frontispiece.

Pyrene Manufacturing Company, 1358 Broadway, New York City, has started an important national advertising campaign directed to something like 15,000,000 readers of the most widely circulated and read magazines and technical papers throughout the country. In a well illustrated folder being sent out by the company these advertisements are reproduced on a small scale. All of them show in a striking manner the value and extensive use of Pyrene hand fire extinguishers. Announcement is also made that the Aetna Accident & Liability Company and the Automobile Insurance Company are now making a substantial reduction in the rate of fire insurance on automobiles provided with Pyrene extinguishers.

H. T. Paiste Company, Philadelphia, Pa., has issued a handsome catalog devoted to standardized wiring material. Since publishing its 1911 catalog the company has added over 360 new articles to the Paiste line which are listed for the first time in this new catalog. The catalog is so arranged that the requirements of any particular character of construction may be easily and quickly discovered, and full information respecting all of the characteristics of the Paiste material and the standard fittings to which it may be adjusted are given concisely and also well illustrated. The catalog is a very interesting and valuable addition to the literature of the subject, and should be in the hands of everyone in any way connected with electrical construction.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued a number of new pamphlets covering railway line material. In catalog section DS840 different types of trolley suspensions are illustrated and described, and also various accessories such as expansion bolts, insulators, clinch ears, trolley splicers, strain ears, wire chucks, etc. Section DS841 covers frogs, crossings, section insulators, switches and lightning arresters; in the lightning-arrester part, pole-type lightning arresters, together with fittings, such as ground plate, ground point and cap, ground bonds, etc., are described together with the proper method of making grounds. Section DS844 covers strain insulators of various types and for different kinds of service. Section DS850 covers rail bonds and bonding tools; this pamphlet gives in detail the methods of manufacture of rail bonds, and also information on the selection of rail bonds; tables are given showing the net weight in pounds per 100 bonds, and installation views of different types of bonds are shown; rail-bonding tools such as ratchet drills, facing tools, bonding punch, bond compressor, portable grinders, torches, clamps, etc., are also described and illustrated.

General Electric Company, Schenectady, N. Y., has issued a number of new publications, of which the following deserve special mention: Bulletin A4176 describes high voltage oil-break switches of the type F, form K15; these switches may be operated by any one of several methods which are described in the bulletin. In Bulletin A4151 are described engine-driven direct-current generators of the commutating-pole type; these generators are manufactured in both two-wire and three-wire styles, and range in capacity from 25 to 400 kilowatts, inclusive. Bulletin A4178 describes three-phase induction-motor panels; these are for controlling motors of voltages from 110 to 2,200, and for operation on 25 or 60-cycle circuits; the panels described are single panels only, and not intended to be assembled as part of a switchboard. Motor-driven exhaust fan outfits form the subject of Bulletin A4174, which contains, in addition to other data, illustrations and dimension

diagrams of the various motors built by the company for this purpose. Bulletin A4167 is devoted to the subject of electricity in iron foundries; this bulletin is profusely illustrated with some typical applications of G-E motors in iron foundries and contains a chapter on foundry lighting. Bulletins A4171 and A4172 describe ventilated commutating-pole railway motors. Bulletin A4131 describes storage battery industrial and mining locomotives; the bulletin outlines the general conditions under which the use of such locomotives is desirable or advantageous, and illustrates and describes various styles and sizes which have been built and placed in service.

Record of Electrical Patents.

Issued by the United States Patent Office, November 25, 1913.

1,079,319. Signaling Device for Letter-Stamping Apparatus. H. Angerstein, assignor to American Stamp & Ticket Vending Machine Co., New York, N. Y. An electric alarm signal.

1,079,320. Automobile. H. A. Baker, St Louis, Mo. Electric heating means for keeping the cooling water and radiator of a gasoline car from freezing in winter.

1,079,324. Automatic Motor-Stopping Device. J. L. Blockburger, Chicago, Ill. An electric brake for a disk phonograph.

1,079,332. Alternate-Current Motor. V. A. Fynn, London, England. The rotor has three axially adjacent groups of laminations, the center one carrying the main winding and the side laminated groups an auxiliary winding of higher resistance.

1,079,337. Gas Valve. E. W. Havers, London, England. Electromagnetically actuated.

1,079,341. Method of Starting Electric-Lighting Apparatus. P. C. Hewitt, assignor to Cooper Hewitt Electric Co., Hoboken, N. J. Provides for locally breaking down the reluctance at the negative electrode of a mercury-vapor lamp.

1,079,342. Electric Gas or Vapor Lamp. P. C. Hewitt and N. W. Rogers, assignors to Cooper Hewitt Electric Co. The method of starting consists in initially causing a localized vaporization by a supplementary electrode and then transferring the current to the other working electrode.

1,079,343. Electric Lighting. P. C. Hewitt, assignor to Cooper Hewitt Electric Co. A mercury-vapor lamp has in parallel with it and wound about its tube an auxiliary starting tube, each tube being started through an inductance.

1,079,344. Electrical Production of Light. P. C. Hewitt, assignor to Cooper Hewitt Electric Co. Each lamp has two tubes for producing a circulation of mercury.

1,079,345. Dynamic Control for Electric Machines. A. E. Hogrebe and J. D. Firmin, assignors to Niles-Bement-Pond Co., New York, N. Y. Control system for a reversing hoist motor.

1,079,346. Method of Making Storage-Battery Electrodes. H. C. Hubbell, Newark, N. J. Consists in electrodepositing a metal on one side of a filament-shaped portion of active material containing finely divided metal to increase its conductivity, and massing together a number of the filaments.

1,079,352. Vacuum-Tight Seal. F. G. Keyes, assignor to A. A. Noyes, Boston, Mass. For a vapor electric tube.

1,079,373. Carrier. J. S. Spirewfki, Jr., Milwaukee, Wis., assignor of one-third each to D. C. O'Connell and S. A. Strzelczyk. An electric suspension railway.

1,079,378. Suction Cleaner. J. H. Templin, Philadelphia, Pa. The motor is mounted directly over the pump.

1,079,379. Outfit for Alternating-Current Vapor Lamps. P. H. Thomas, assignor to Cooper Hewitt Electric Co. Includes a current-regulating ballast in the lead to one positive electrode.

1,079,380. Circuit-Interrupter. P. H. Thomas, assignor to Cooper Hewitt Electric Co. A symmetrically arranged subdivided rotatable mercury bulb with two electrodes and a partial central partition.

1,079,386. Motor Controller. T. E. Barnum, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. Solenoid-operated combined starting box and shunt-field-resistance regulator.

1,079,389. Electric-Railway Truck. W. L. Boyer, Kingston, N. Y. Relates to the arrangement of the supporting framework.

1,079,400 and 1,079,401. Car-Lighting System. W. Cooper, assignor to Westinghouse Electric & Mfg. Co. A dynamotor arrangement for supplying the lamps at constant voltage from a 600-1,200-volt electric railway system.

1,079,408. Trolley Guard. M. Guariglia, Morgantown, W. Va. A guard arm on each side of the trolley wheel.

1,079,410. Circuit-Breaker. P. C. Hewitt, assignor to Cooper Hewitt Electric Co. A rotatable mercury contact-maker and breaker.

1,079,413. Ignition Apparatus for Hydrocarbon Engines. R. Huff, assignor to Packard Motor Car Co., Detroit, Mich. Includes a battery, a generator and a transformer for each source.

1,079,427 and 1,079,428. Apparatus for Electroplating Pipes. D. H. Murphy, assignor to American Conduit Mfg. Co., Pittsburgh, Pa. The conduit pipes are rolled through the tank from end to end while the plating is done, to insure uniformity of deposit.

1,079,445. Support for Conduit Cables. E. H. Smith, Cleveland, O., assignor of one-half to W. H. Hartman. Bayonet slots in an unright channel bar receive the bolt heads of bracket arms on which are mounted rollers.

1,079,451. Automatic Car-Stopping Device. J. S. Strickland and C. H. Beach, Tacoma, Wash. Combined with an electric signal circuit and a trolley circuit is an electromagnetically operated device for acting on the control circuit of a passing car.

1,079,467. Search-Call Apparatus. A. F. Boardman, Arlington, Mass., assignor of one-half to J. R. Murphy. An electric signal system with a number of differentiated rotating contact disks.

1,079,472. Crank Arm. E. B. Craft, assignor to Western Electric Co. A generator crank formed from a sheet-metal blank.

1,079,480. Motor-Control System. J. Eaton, assignor to General Electric Co. Includes two electromagnetic reversing switches.

1,079,483. Electrical Sign Receptacle. E. H. Freeman, assignor to E. H. Freeman Electric Co., Trenton, N. J. Comprises a number of telescoping cups, wire terminal plates on one of them and plug contacts on the other.

1,079,502. Dynamo-Electric Machine. W. Linke and L. Dreyfus, assignors to General Electric Co. A polyphase machine having a winding for each phase and generating dissymmetrical E. M. F.'s, and a phasing transformer with primary connected to an outside source and three secondary coils Y-connected to the three phases to render them symmetrical.

1,079,503. Apparatus for Sterilizing Liquids by Means of Ultra-Violet Rays. O. Linker, Leipzig, Germany. A quartz lamp with liquid-conveying tube passing longitudinally through its center.

1,079,526. Typewriting Machine. C. H. Vogel, assignor to Underwood Typewriter Co., New York, N. Y. Electrically operated.

1,079,532. Adjustable Timing Apparatus for Electric Ignition Systems. A. Zähringer, assignor to firm of Robert Bosch, Stuttgart, Germany. Comprises a cam ring with circumferential ledge, a timing lever with socket adapted to engage the ledge, and a clamping screw for tightening the socket on the ledge at any point to which the lever may be adjusted.

1,079,533. Telephone Switching System. W. Aitken, Liverpool, England. Includes a pair of double-throw key switches and electromagnetic means for holding one of them in either of two positions, this switch being adapted to restore the other switch to normal position.

1,079,546. Magnetic Chuck. L. W. Downes and A. W. Faxon; said Faxon assignor to D. & W. Fuse Co., Providence, R. I. An electromagnet coil surrounds a cast-iron core with mild-steel pole plates.

1,079,549. Attachment for Moving-Picture Machines. F. H. Frude, Chicago, Ill., assignor of one-third to S. I. Levin. Stopping of the take-up reel opens a switch in the lighting circuit.

1,079,554. Brush-Holder for Dynamo-Electric Machines. J. H. Holmes, Newcastle-upon-Tyne, England. Is arranged to give a rectilineal feeding motion to the brush.

1,079,588. Electric Retort-Furnace. J. Bally, Grenoble, France. An inductor rotates in a central space around which is a series of parallel conductive retorts surrounded by a magnetic frame.

1,079,621. Thermoelectric Couple. E. Weintraub, assignor to General Electric Co. One element is composed of boron with small amount of carbon.

1,079,629. Resistance Ring of Rotors.

J. M. Barr, assignor to Fairbanks-Morse Electrical Mfg. Co., Indianapolis, Ind. A squirrel-cage rotor has a resistance ring with a groove cut to a point where the bars are united with the metal of the ring.

1,079,649. Electric Bell. A. Jacobsen, Fruitvale, Cal. The striker touches the inside of the bell tangentially. (See cut.)

1,079,651. Platform Indicator. C. J. Kintner, New York, N. Y. When a car rolls onto a platform indicating circuits are closed.

1,079,660. Incandescent-Electric-Lamp Socket. E. A. Olley, assignor to Crouse-Hinds Co., Syracuse, N. Y. Sign receptacle with a base engaging the rear of a supporting wall.

1,079,667. Electric Fire-Alarm System. J. G. Schlüchtner, Brooklyn, N. Y. Includes a primary circuit-closer in each branch and a normally impelled train of secondary circuit-closers for the different branches.

1,079,705. Process for Synthetically Preparing Ammonia and Other Compounds containing Nitrogen and Hydrogen. F. Hlavati, Vienna, Austria-Hungary. Consists in ionizing by electrical discharges a gas mixture containing the elements.

1,079,708. Vapor Electric Lamp. O. O. Kruh, assignor to General Electric Co. Provides means for impressing a high voltage on a main electrode, and one of the starting electrodes.

1,079,709. Battery Support. R. McA. Lloyd, assignor to General Electric Co. The battery cradle is hung to the body of an electric vehicle by hooks to permit ready lowering of the cradle, but to prevent its swinging.

1,079,715. Lamp Support. K. J. Ohlson, Chicago, Ill. An extensible bracket for an electric lamp.

1,079,720. Cord-Adjuster for Electric Lights. P. L. Pritchett, Fort Worth, Tex. Within the canopy is a spool for winding the cord, hangers for the spool serving to carry current to the cord. (See cut.)

1,079,725. Electrical Engine-Starter. S. W. Rushmore, Plainfield, N. J. A series starting motor has its armature current weakened until the motor is connected to the engine.

1,079,727. Process for Bleaching and Thickening Oils and Fats. O. Scherieble, Esslingen, Germany. Consists in passing a high-potential discharge through the oil in the presence of oxygen.

1,079,740. Pull-Socket Switch. F. Barr, New York, N. Y. Special chain guide.

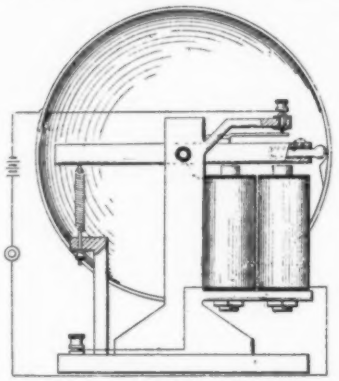
1,079,754. Sign and Indicator. P. Ficcio, Tampa, Fla. Electric taillight with ruby and green glass surrounding plates, and a prism for throwing the light upon the number plate.

1,079,760. Answering and Recording Telephone. C. J. Gustafson, Aberdeen, S. D. Has an answering phonograph for automatically transmitting a message on the line, and an automatic phonographic mechanism for registering messages received from the line.

1,079,777. Manufacture of Incandescent Bodies of Metallic Tungsten or Molybdenum for Electric Incandescent Lamps. A. Lederer, Atzgersdorf, near Vienna, Austria-Hungary. Consists in mixing sulphur at a moderate temperature with a tungsten compound, kneading the mixture to a paste, forming filaments therefrom, drying them, heating the filaments in the presence of a reducing gas, and passing a current through them in vacuo.

1,079,791. Electric Time-Switch. G. E. Morden, Detroit, and J. L. Chapman, Ann Arbor, Mich. Operated by a clock mechanism with setting dial.

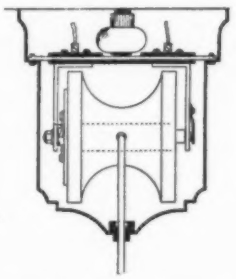
1,079,804. Filament Lamp. M. Sidon, New York, N. Y. One of the leading-in wires of the lamp is connected to the supporting rod.



1,079,649.—Electric Bell.

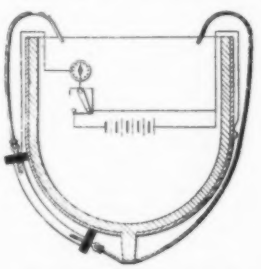
1,079,851. Changeable Sign. B. Fried, Budapest, Austria-Hungary. Has electric operating mechanism.

1,079,895. Electric Heater. I. F. Talbot, assignor to E. O. Atwood, Boise, Idaho. In the secondary circuit of a transformer is a flat strip of resistance metal imbedded in a heat-transmitting substance.



1,079,720.—Cord Adjuster.

1,079,917. Electric Motor-Wheel. K. Knudsen, assignor to Electric Wheel Co., Springfield, Mass. The motor is in the hub, but has its armature shaft at right angles to the wheel axle, a bevel pinion on the motor shaft driving an annular gear in the wheel rim.



Reissue 13,652.—Electrolytic Ship-Bottom Cleaner.

1,079,926. Electric Vapor Apparatus. C. O. Bastian, assignor to Cooper Hewitt Electric Co., Hoboken, N. J. The cathode of a mercury-vapor lamp has a heat-dissipating extension.

Reissue 13,652. Electrolytic Ship-Bottom Cleaner. G. W. Frazier, deceased; Pittsburgh Electrolytic Mfg. Co., Pittsburgh, Pa., assignee. Original No. 820,105, dated May 8, 1906. A zinc plate is adjustably suspended adjacent to the hull and connected to one side of the circuit, the hull being connected to the other side. (See cut.)

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired December 1, 1913.

572,111. Combined Electric and Gravity Pleasure Railway. J. A. Griffiths, Philadelphia, Pa.

572,124. Insulated Joint for Light Fixtures. W. McElroy, Brooklyn, N. Y.

572,131. Electric Clock. J. A. Schulte, Arcadia, Iowa.

572,158. Electric Sign. W. Connell, Pittsburgh, Pa.

572,162. Magnetic Separator. J. B. Hamilton, Springfield, Mass.

572,169. Electrically Actuated Railway Switch. R. M. Hunter, Philadelphia, Pa.

572,182. Telephone Transmitter. F. A. Ray, Boston, Mass.

572,188. Telephone Transmitter. L. D. Appleman, Waynesboro, Va.

572,198. Accumulator. F. W. Ellermann, Vienna, Austria-Hungary.

572,215. Insulated Electric Conductor. W. R. Patterson, Chicago, Ill.

572,218. Needle-Plug Test System for Multiple Switchboards. C. E. Scribner, Chicago, Ill.

572,219. Cord Switch for Telephone Switchboards. C. E. Scribner.

572,220. Electric Signal Bell. C. E. Scribner.

572,221. Telephone Exchange System. C. E. Scribner.

572,222. Telephone Circuit. C. E. Scribner.

572,223. Apparatus for Telephone Switchboards. C. E. Scribner and F. R. McBerty.

572,285. Battery Cell. C. Willms, Baltimore, Md.

572,301. Electric Door-Operating Apparatus. O. H. Hicks and R. F. Troy, Chicago, Ill.

572,319. Electric Switch. C. B. Sterling, New York, N. Y.

572,354. Electric Lamp-Post. J. Buckner, Boston, Mass.

572,369. Magnetic Ore Separator. C. J. Reed, Orange, N. J.

572,370. Mechanism for Separating Magnetic from Nonmagnetic Substances. C. J. Reed.

572,377. Electric Towing Apparatus. A. E. Schatz, New York, N. Y.

572,378. Annunciator Drop. W. Schwagerman, Yonkers, N. Y.

572,380. Voltmeter. A. A. Simonds, Dayton, O.

572,421. Regulator for Electric Incandescent Lamps. W. Hawker, Montreal, Can.

572,430. Electric Lighting Mechanism for Bicycles. F. A. Magee, Brooklyn, N. Y.

572,431. Electric Lamp. F. A. Magee.

572,438. Cell or Box for Electric Batteries. J. M. Moffat, London, England.

572,467. Electric Heater. B. E. Baker, New Britain, Conn.

572,472. Anode for Electrolytic Processes. H. Y. Castner, London, England.

572,510. Method of and Apparatus for Transforming Alternating Electric Currents. M. Hutin and M. Leblanc, Paris, France.

Electric Vehicle Section

THE INDUSTRIAL TRUCK AS A FACTOR IN THE EFFICIENT HANDLING OF INTERNAL FREIGHT.[1]

By W. W. White.

The word "Industrial" as applied to the electric truck represents, in a broad sense, a classification rather than a type, since there are many special applications of what is called the freight truck. I would place under the heading of "Industrial Trucks" the battery truck crane, the freight truck, the baggage truck and certain types of tractors, all electrically propelled. Each type has its special fitness for certain kinds of work, the freight truck in particular being very elastic in the range of service performed and elastic also in the special equipment which may be added to it, such as hand-winches, small hoists, booms, etc.

The battery truck crane, the baggage truck and the electric tractor might be called refinements of the simple freight truck, their functions varying somewhat in each case. The applications of the first mentioned vehicle may be divided into three classes: hoisting, hoisting and carrying on the hook, towing trailers. The baggage truck has a field of its own in the handling of baggage and mail, many advantages being claimed for the drop frame and double platform types, and others for those having battery and driving mechanism below the paltform. The industrial tractor (also electric) is slowly filling the need for a trackless engine capable of towing trailers of various types.

The simple industrial or freight truck is built in sixes and capacities suitable for moving loads on piers, in freight sheds, warehouses and industrial establishments generally. Its clearance and radius of action permit it to pass through congested places, going forward or backward with ease and facility, and it is capable of ascending gradients of 10 to 25 per cent. On piers and railway terminals it can deliver its load on the deck of a vessel or within a freight car. In a warehouse or store it can carry its load from floor to floor wherever wanted with a degree of celerity otherwise impossible. In the factory it carries materials direct to the place where needed and at the precise time when needed, something impossible with moving apparatus working on a fixed track; and at the same time does it more quickly and more economically than can be done with the use of hand trucks.

The capacity of such trucks is usually 2,000 pounds, that having been found the practical limit for trucks capable of the widest range of action. The larger sizes must of necessity take up more room, and as the size increases greater clearances are required. The size and style suitable for a particular business always depends on the working conditions. For the great majority of cases, however, the truck of 2,000 pounds capacity is ample. Few hand trucks are required to carry this much, and when they are they require several men to pull or push them. The loading space of the 2,000 pound type is roughly 28 square feet, while the total area required for movement is but 34 square feet in other words, they have an extreme width of four feet and an extreme length of eight feet. (Special sizes for handling baggage, mail, etc., are usually longer.) Hence it is that where a hand truck can go, the industrial truck can go, while the latter can overcome grades that are impossible for hand-operated trucks.

G. V. Industrial Truck, Standard 2,000-Pound Type.

This truck is considered the simplest of all such trucks electrically propelled, having the minimum number of parts. Both battery and driving mechanism are mounted below the platform, which accordingly is free and clear to carry not only a compact load, but iron pipe and similar material. The platform with its rounded corners is extended so as to protect the mechanism and running gear in every direction.

Speed on hard, level surfaces, seven miles per hour; average radius, 25 miles per single charge of the battery. Current consumption full charge of the battery six-eighths kilowatt-hours. All mechanical parts of the truck are accessible; weight, 2,050 pounds; turning radius seven feet.

This truck has single reduction gearing, and in the case of two motors each rear wheel is driven by an individual motor geared to a housed spur gear fastened to the wheel. With us one motor has been standard for grades up to 10 per cent. Silent chains, sprockets, counter-shafts, differentials, internal gears, or universal joints have been done away with. Each wheel has two complete self-lubricating Timken roller bearings. The controller is inclosed and an automatic cut-off switch minimizes accidents. One handle is used as controller lever, and the other handle for steering. The controller returns to neutral as the hand is removed from the lever. The cut-off switch cuts off the power when the foot is removed from the brake pedal. This brake is spring operated, and sets immediately as the foot is removed from the brake pedal. In other words, the driver applies the brake simply by releasing the pedal with his foot, and as he releases the pedal the power is cut off automatically.

The driver standing erect on the end of the truck with hands on controller and steering lever respectively, and foot on the brake pedal, is in the best possible position to guide and control his load. The simplicity of operation does away with the necessity for hiring expensive operators. The average freight handler, colored or white, being taught to successfully operate same, even in congested plants or terminals, in about 48 hours.

Freight Congestion and How It May Be Remedied.

Long before we had the motor truck it was very evident that something was wrong with the horse method of trucking, but few of us realized to what extent the power wagon was to figure in a general shake-up of trackless transportation methods. When we were provided with something which established a standard of comparison, we began to see why the horse was inefficient, and now that we have something against which to weigh the hand truck, we see its inefficiency.

Freight congestion at docks and freight terminals is caused by cramped quarters, old-fashioned methods, absence of proper schedules and lost motion due to these conditions. A pier on the North River is not elastic, at least laterally, neither is a freight house where it covers all the ground which can possibly be spared for the

[1]Read before the Electric Vehicle Association of America, at its monthly meeting in New York, November 25, 1913.

purpose. Where a pier is handling from three to five times the freight it was originally designed to handle, and a freight shed or a series of freight sheds fixed as to floor areas becomes a double mouthed funnel through which must pass an ever increasing volume of incoming and outgoing merchandise, it is not surprising that congestion, resulting in confusion and expensive delays, should result. It is all very well to talk about longer piers and larger terminals, but these in many cases are physical, if not financial, impossibilities. We must work with what floor areas we have for the present, and by bringing efficient methods to bear upon the handling of such merchandise, endeavor to relieve the pressure until such time as fundamentally improved conditions are made possible.

This condition finds a parallel at the freight terminals of some of our railroads in at least the larger cities, and to a lesser degree in many of our large industrial plants where the hand truck—that relic of bygone efficiency—is still practically the only method of moving a five-pound box of salt, a case of shoes, a piano, or a two-ton casting. The industrial railroad, the inclined elevator, and the gravity conveyor are all helpful and practical under certain conditions, but relatively few have been placed in service, and in many cases they are not sufficiently elastic to meet major requirements.

It is this general condition of affairs which has brought about the successful development of the electric truck, and enabled it to demonstrate its economic value. The truck is sufficiently elastic to meet the needs of steamship piers, railroads, and industrial plants of many kinds. We thought at first it might not pay in hauls of less than 1,000 feet, but this idea has been dissipated most conclusively. Like its predecessor, the electric motor truck, it will pay almost anywhere if you keep it busy. In many cases it has been found both possible and practical to give it a load going and coming, and under these conditions its economies (in reality its earnings) are phenomenal.

Thirty-seven carriers and firms are now using 208 G. V. freight trucks of the 2,000-pound type, and 23 per cent of these are undoubtedly test machines. That is, they represent initial orders where a steamship company, a lighterage firm or a manufacturing plant has placed one in service with a view to determining the feasibility of discarding hand trucks entirely, and in some cases substituting inclines for freight elevators; moving goods direct from car to warehouse and vice versa by means of the small electric; transporting raw material over planked or paved route in the mill yard as against trucking it with horses. The possibilities of economy in the iron and steel trade alone are enormous, and the uncertain labor factor in the big cotton ports will eventually be steadied by the use of such trucks. They are already being called electric stevedores.

It is obviously too early to determine to the last cent just how much can be saved by the adoption and use of these small trucks. The labor item is the most important one, and we have found that where the trucks can be kept busy and the hauls average 200-800 feet that each truck will displace at least four and often five or six men each. The 21 trucks used on the Fall River Line pier are credited with saving in labor alone $63 per day, or a total of $18,900 per year.

In moving heavy units such as drums, casks of oil, heavy bales and cases, the truck will do the work of five or six hand trucks and even when it has to wind about teams and standing freight, it will deliver its load in about one-third the time consumed by hand trucks, which frequently block themselves in the narrow, sinuous aisles.

Time studies of comparative work of this kind are interesting. On Pier 14, four men required 30 minutes to unload 38 bags of cement and transport them a distance of 500 feet. By means of the electric, two men required but 17 minutes to unload 70 similar bags and transport them 1,500 feet into the hold of the vessel. The writer observed four men load two pianos from the loading platform on the truck in 2.3 minutes, three men load two drums weighing 1,300 pounds each in one minute. A truck was loaded with 104 packages of dry yeast, and the load roped on by three men in 3.48 minutes; three men loaded one drum, one cask of oil, one barrel of beans, and seven small cases of dried peaches in 1.47 minutes. Ten barrels of sweet potatoes were loaded by two men in two minutes and twelve seconds, three barrels being brought across the platform from wagon to truck.

In Ambler, Pa., the general superintendent of an asbestos, slate and sheathing company states that "there have been days when we have moved as much as 1,000 tons of material with the first truck purchased, resulting in a net saving to us, in labor, of 16 men." This result was obtained by operating practically 24 hours with two interchangeable batteries.

The various railroads using these trucks are not disposed at present to indicate what economies are made possible by their use, but the fact that they continue to add to their equipment of same would indicate general satisfaction. The truck used in hauling coal is another very happy solution of one mill yard or fuel problem. One small truck used in Montreal is equipped with a hand winch for warping on heavy coils of wire, while still another truck in another city has joined the fire prevention corps, being equipped with hoist and fire extinguishers and ready to move quickly to any part of the floor. The increasing use of trailers is another development, though I regret that I have no data on this phase of their work.

No less than 12 of these machines are used by one textile plant in New England chiefly for carrying rolls of print cloth from the storehouse to the printing machines, for carrying dye from the color room to the machines, empties forming the return load.

The advantages of this type of storage battery truck are already evident to the officials of railroad and steamship companies, and to many manufacturers and warehousemen. The wholesale grocers and dry goods people are becoming interested, and soon we shall see a great improvement in the handling of internal freight through its use. We have ample proof, and so have other manufacturers of similar apparatus, of its practicability and efficiency.

It should not be overlooked that this small truck has many of the fundamental advantages of its larger brother in the street, namely: it is clean, odorless and practically silent; its simplicity of construction is a great aid in operation and maintenance, and its freedom from fire or explosion commend it to fire commissioners and underwriters.

Sectional Book Case Idea Applied to Battery-Charging Panels.

Owing to the steady increase in the use of electric passenger and commercial vehicles, charging stations are called upon at frequent intervals to increase the capacity of the charging equipment. Because of this it is advantageous to install equipment to which additions can be made easily and economically. The new Universal unit-type charging panels made by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., are made up of self-contained rheostats assembled in frames in much the same way that the present day efficient sectional filing cabinets or book cases are assembled, such standard panel accommodating any number of sections up to six. Any number of panels can be assembled side by side according to the space available and regardless of the fact that these may be installed at different times, the complete equipment will have the same appearance as if installed at one time. These panels are

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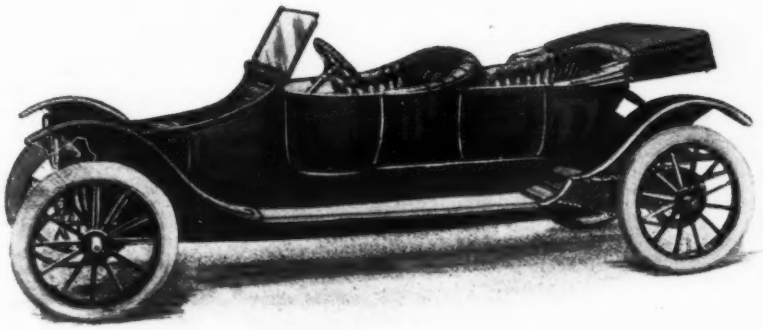
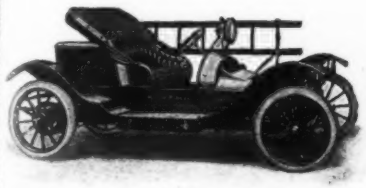
Edison Battery

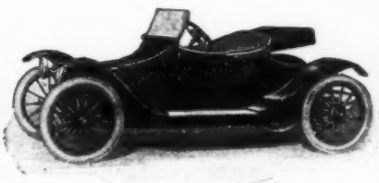


Four Passenger Roadster

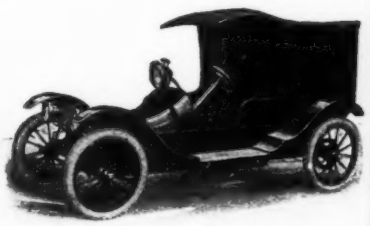
THE LATEST BAILEY



Trimming and Patrol



Runabout



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Commonwealth Edison Co., Chicago (4).
Malden Electric Co., Malden, Mass. (3).
Omaha Electric Light & Power Co., Omaha, Neb. (2).
Blackstone Valley Gas & Electric Co., Pawtucket, R. I. (2).
Schenectady Illuminating Co., Schenectady, N. Y. (2).
Worcester Electric Light Co., Worcester, Mass. (2).
Haverhill Electric Co., Haverhill, Mass.
Franklin Electric Light Co., Turners Falls, Mass.
Minneapolis General Electric Co., Minneapolis, Minn.
Stamford Gas & Electric Co., Stamford, Conn.
Salem Electric Lighting Co., Salem, Mass.
Montreal Light, Heat & Power Co., Montreal, Can.
Concord Municipal Light Plant, Concord, Mass.
Lynn Gas & Electric Light Co., Lynn, Mass.
Cambridge Electric Light Co., Cambridge, Mass.
New Bedford Gas & Edison Light Co., New Bedford, Mass.
Harrisburg Light & Power Co., Harrisburg, Pa.
Edison Electric Illg. Co. of Brockton, Brockton, Mass.
Commonwealth Water & Light Co., Summit, N. J.
Consumers Electric Light & Power Co., New Orleans, La.
Suburban Gas & Electric Co., Revere, Mass.
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for use on both two-wire and three-wire circuits.

Each charging section is a unit in itself as shown in Fig. 1. This consists of a slate front 24 inches by 10 inches, carrying the rheostat contacts and

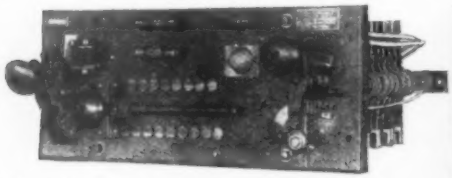


Fig. 1.—Charging Section, Unit Type Charging Panel.

sliding brush; a low-current circuit-breaker, at left side; an instrument switch, at right; a pilot lamp and grid-type resistance mounted on the back. On the upper left-hand corner of the front a card holder is provided in which a card bearing the designation of the charging circuit can be inserted. Each section is supported by bolts to the frame and after disconnecting from

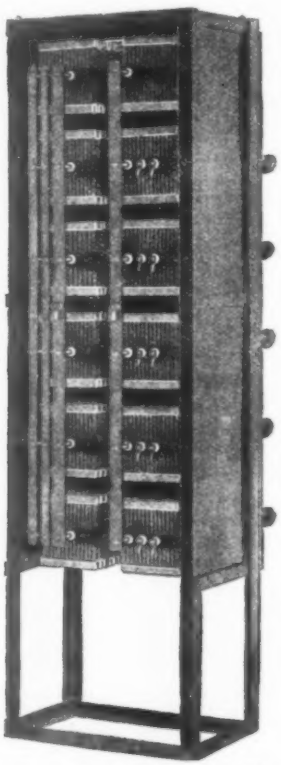


Fig. 3.—Rear View, Unit Type Charging Panel.

the bus-bar can be readily removed if these bolts are taken out. For repairs or inspection a section can be taken out about as easily as a drawer or section from a filing cabinet.

The low-current circuit-breaker mounted at the left of the front is interlocked with the rheostat so that it cannot be closed except when the sliding brush is moved to the position of "all resistance in." It can then be closed and a small magnet which is in series with the charging circuit holds it in this position unless the charging voltage falls to a value less than the battery voltage or in case the service fuses should be blown. It thus acts as a line switch.

The instrument switch is a three-position switch having "Open," "Closed" and "Reading" positions. When in the "Open" position the circuit to the battery is broken; moving to the "Closed" position completes this circuit, and when in the "Reading" position the meter, which may be mounted on the top section or on a swinging bracket, is connected in the battery circuit indicating the voltage of the battery. If the low-current circuit-breaker is closed, the current is also indicated on the ammeter scale of the instrument.

The duplex instrument which is furnished combines ammeter and volt-meter and a single instrument can be used for several panels, if desired. The scales are five inches long and thus allow close readings.

The indicating pilot lamp is connected directly across the battery leads, and is lighted whenever a battery is connected to the rheostat.

A discharge rheostat is mounted on the top section of some panels to operate in conjunction with the charging rheostat section directly below it. A single-pole double-throw switch short-circuits the discharge rheostat directly to the line. When closed to the right, the switch connects the discharge rheostat in series with the charging rheostat and connection is made so that with the instrument switch closed the battery will discharge.

As can be seen by referring to the illustration, Fig. 2, everything is within easy reach, and no operating rods are required. The rheostat being arranged adjacent to the controlling switch, eliminating the chance for error in

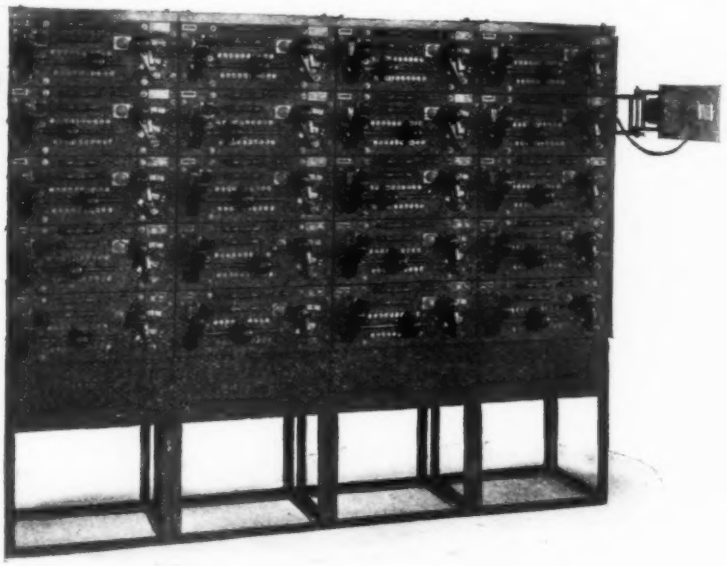
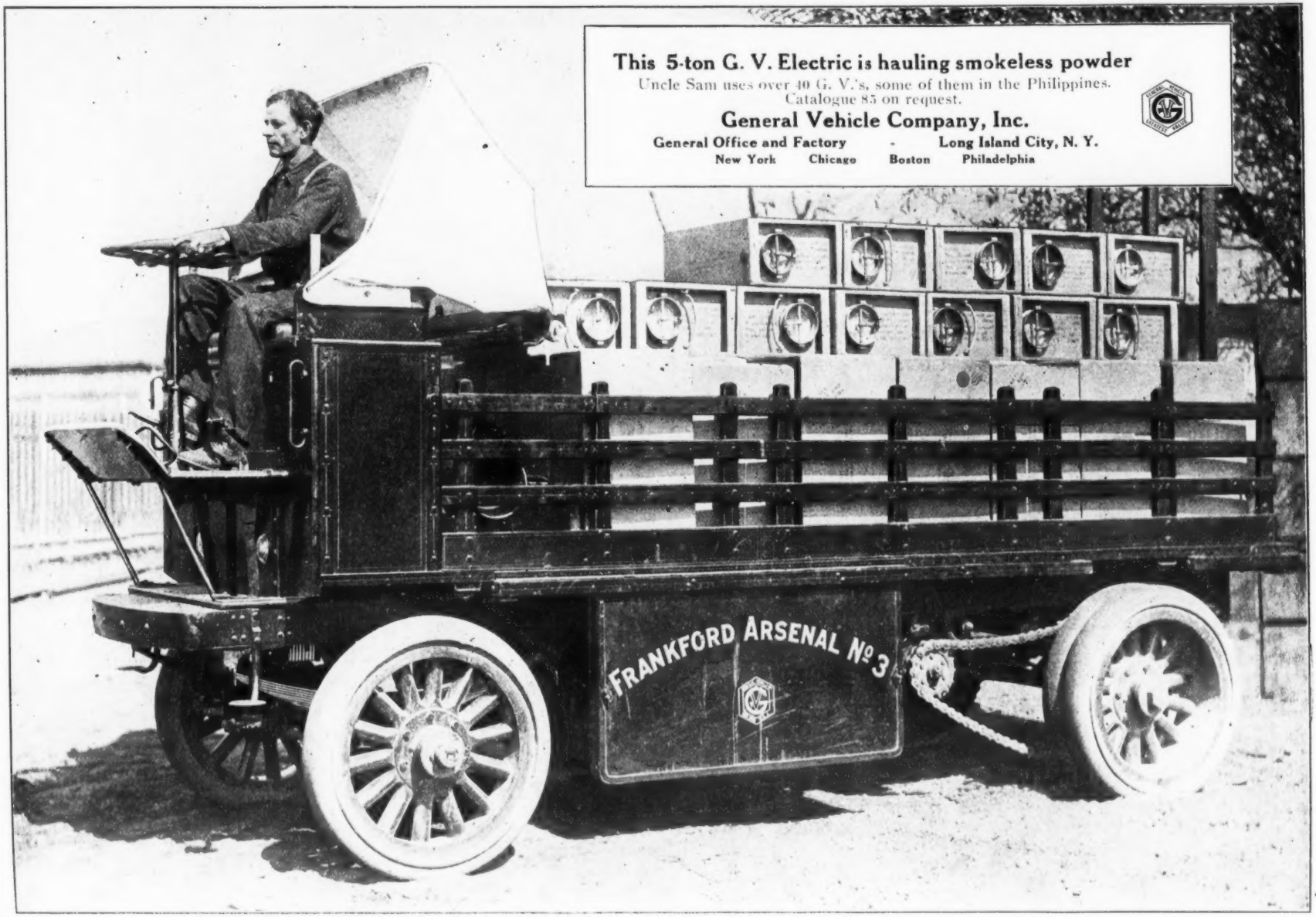


Fig. 2.—Assembled Sections, Unit Type Charging Panels.

operating the wrong rheostat. Meter readings are made without opening the charging circuit. The voltage and current may be read at any time by moving the corresponding instrument switch to the "reading" position. It is not intended that more than one of these switches be operated at one time but should anyone through ignorance move two at once, no damage will result, as by a special arrangement of the voltmeter connections, the cross currents resulting are made ineffective. When it is desired to stop the charge, the circuit is opened by moving the instrument switch to the "open" point, the arc formed on opening the circuit being taken on the auxiliary contacts. This opening of the circuit de-energizes the low-current circuit-breaker which opens, disconnecting the battery from both sides of the line. When the plug is removed from the vehicle, the charging cable is entirely dead. The rear view, Fig. 3, shows the connection arrangements and layout.

Dayton Electric Car Company in Good Shape.

J. W. Baker, of the Dayton Electric Car Company, Dayton, Ohio, states that the company is pretty well sold up on 1913 models. The company was greatly hampered in production on account of the flood last March, when there was nearly 20 feet of water in the plant. This not only damaged stock, but stopped factory operations.



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A New Luxurious Broc Double-Drive Brougham.

To provide for the increasing demand for electric vehicles the Broc Electric Vehicle Company, Cleveland, O., is preparing to place on the market eight models for its 1914 line. These eight Broc cars will include four-passenger and five-passenger broughams, some of which are provided with front drive, others with rear drive and the latest model with double drive. This new model is known as the No. 36, an inside view of which is shown herewith.

The general appearance of the car shows attention to elegance and graceful outlines. A conception of the beauty of its interior appointments can be gained from Fig. 1. This is a five-passenger car, in which both the front seats are mounted on pedestals so as to revolve; they are of ample size, the dimensions being 19 by 18 inches. Between the rear seat and the back of the front driving seat is a clearance of 14 inches.

Probably the most distinctive feature of this new car is the arrangement for double driving from either the front or the rear seat, depending upon the number of persons in the car. Fig. 1 shows at the extreme right the two operating levers, the upper one being the control lever and the lower the steering lever. At the side of the rear seat, just back of the front driving seat, is a duplicate set of these levers. An ingenious interlocking arrangement is provided, so that when the front control is used the two levers adjoining the rear seat are swung down and locked in place so that the occupant of the rear seat cannot by any possibility attempt to interfere with the operation of the car. In this lowered position the levers are out

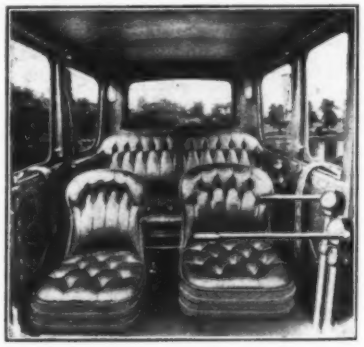

Fig. 1.—Interior View of Broc Double-Drive Brougham.

of the way and current is shut off from the control handle. A similar arrangement is provided for locking in the lowered and idle position the front operating levers, when the car is to be operated from the rear seat. This arrangement insures safety of operation. The steering and control levers project from the ball caps at the top of their respective posts; no complicated or unsymmetrical mechanism detracts from the interior of the car.

Another interesting feature in this car is the provision of folding foot-brake pedals; the idle pedal, that is the one not in use by the operator, can be folded flat on the floor of the car. This not only insures noninterference by other occupants of the car but at the same time frees the floor of the car from the obstruction of the other brake pedals.

The transmission system provided between motor and driving wheels is a double-reduction gear, including a spur and a beveled gear. The control equipment is on the series-parallel system, thus dispensing with the need of control resistances. Despite the size and commodious nature of the car, it is actually of relatively light weight and the manufacturer claims that, in connection with the highly efficient transmission and control equipment, this permits of considerable saving in the battery. Thus charging as well as the battery upkeep and renewal cost are reduced. The battery equipment consists of 40 cells, providing a long mileage per charge and satisfactory speed for a car of this type.

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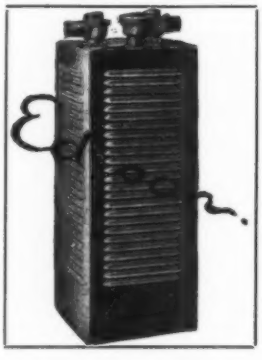

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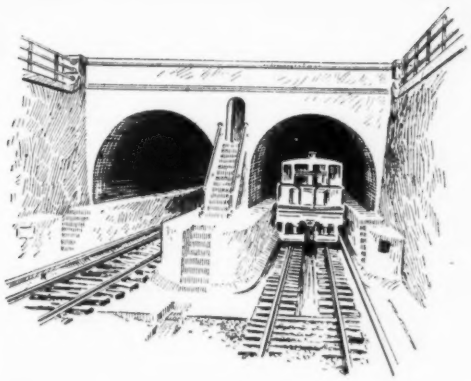

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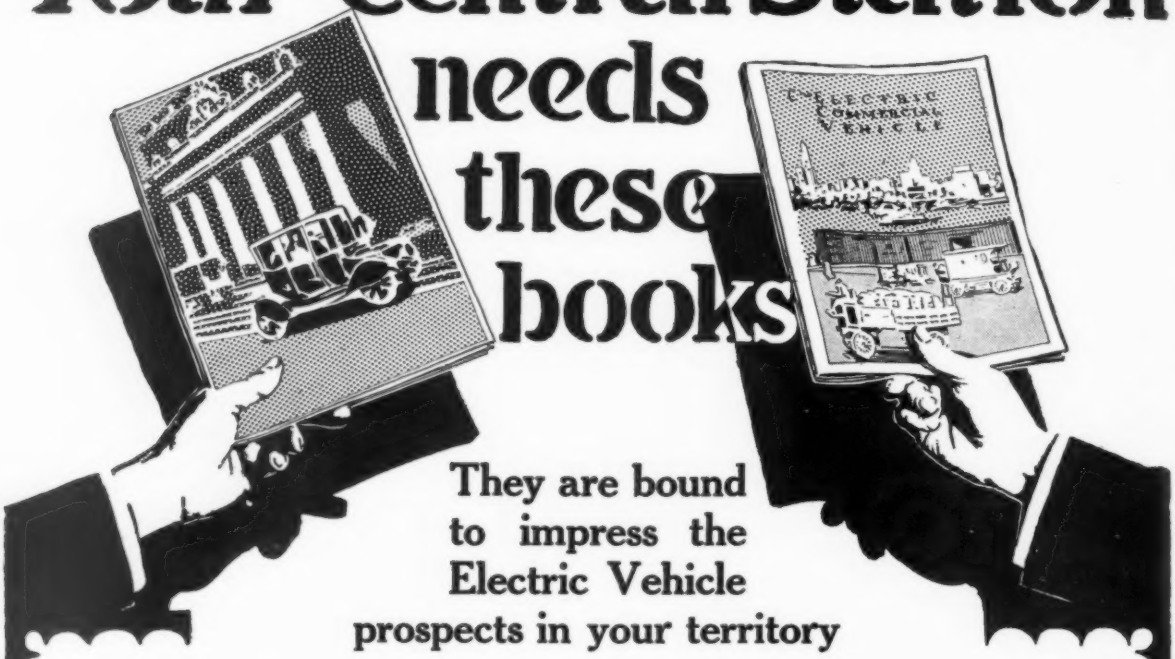
Your Central Station needs these books



They are bound to impress the Electric Vehicle prospects in your territory

UNDOUBTEDLY you have Electric Vehicle prospects in your territory. You have worked on them—talked to them. Hasn't it frequently occurred to you that a concrete presentation of the merits of the Electric would be a big help to you?

Just suppose that at the close of your personal solicitation you could hand your prospect a beautifully printed booklet and say, "Here is the whole story". That is just what these two booklets—"The Story of the Electric Pleasure Vehicle" and "The Story of the Electric Truck"—will enable you to do.

These booklets have been prepared as part of the publicity work of the Association for the 1913-14 campaign. They are written with all the interest of a story, profusely illustrated in two colors with pictures of all types of Electrics in different settings—the covers of both booklets are poster effects in three colors by a well-known artist.

These booklets are bound to impress anyone who is considering the purchase of an Electric Vehicle—they will awaken interest in the Electric among those who do not know its merits. It is possible for you to secure a quantity of these booklets for work in your territory—at a nominal expense.

Here is a real chance to do something for the cause—for your own Central Station. Send for a sample of either one or both of the booklets—judge them on their merits; and we will give you full particulars of the cost and how to use them. Do this now—before you turn the page.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA

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